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Editorial

Rifts in the Clouds

America is by temperament optimistic. We cannot think in terms of defeat. Perhaps it is mainly for that reason, but perhaps it is also for reasons based on solid facts that we are taking the opportunity here to point out the encouraging aspects in the present situation.

Private building at this time is increasing in response to the FHA drive.

Mill operations in the brass manufacturing centers is markedly above the rate of a month ago. In other words the trend is upward.

It is the general belief that metal prices are scraping bottom.

According to the present temper of Congress, the new tax bill will eliminate the onerous imposts, surplus profits, "third basket," etc., which have had such a dampening effect on business.

And last (but to our minds, not least) this is a political as well as economic depression. Conditions that are made politically can be unmade politically. It will be decidedly to the interest of those in political power to have conditions improve before the coming elections in the Fall.

Vague and indefinite? Perhaps. But none-the-less indicative.

A Metal Newcomer

Another metal joins the "freshman" class of industry. At the recent meeting of the Institute of Metals Division (see METAL INDUSTRY, March, page 125), *C. F. Smart* described a method of treating bearing metals with indium. Indium was deposited upon the bearing surface of steel backed bearings lined with cadmium-silver-copper alloy and then heated to obtain alloying and diffusion of the indium into the bearing metal. The bearings were finish-machined, electrocleaned in an alkaline solution, rinsed and plated in an indium cyanide bath. The reason for the addition of indium was protection against corrosion of the bearing by the lubricants containing organic acids, especially in gasoline engines.

The advantages of this type of bearing will be better known after the conclusive test of service in the field. For the present, however, what interests us is the fact that we still have room for new materials and that electroplating finds another place in the industrial picture.

Silver Falls

Almost immediately after the announcement by the Treasury Department that our Government would buy no more silver from Mexico after April 1st, a decline in world silver prices occurred. The Treasury cut its buying price for foreign silver to 44c per oz. Troy, and then to 43c from 45c which had been in effect since January 30, 1936. The New York official price immediately dropped from 44¾c to 43¾c and then to 42¾c.

The fundamental policy of our Government with regard to silver is still a deep, unsolved mystery.

Platers Research Fund Contributions

In response to several questions from readers concerning the figures published in these columns in our February issue, we are glad to clarify our statement. It is true that the American Electro-Platers' Society has contributed about $20,000 (out of a total of $50,000) to date. We are informed, however, that approximately three-quarters of the $20,000 was contributed by manufacturers, and the balance by Branches of the A.E.S. and by the National Society. We add these details in fairness to the manufacturers who have been shouldering such a large part of the financial burden of this important research.

In the meantime work on the Platers' Research Fund is under way. We repeat what we have already said in these columns: it is a most profitable investment for manufacturers of electroplated product.

Electroplaters' Convention

The time is approaching when the great gathering of electroplaters—the Annual Convention of the American Electro-Platers' Society, will be held in Milwaukee, Wisc. Preparations are proceeding at full speed, the program is being developed and arrangements for plant visitations and entertainment are taking form. Important papers have been scheduled.

It is not too soon, therefore, for electroplaters and manufacturers interested in electroplating to set aside the week of June 13th for the purpose of attending this convention. Begin to make plans now.

Cost and Control of Polishing Supplies

How obtained and used for estimating and costs in metal products manufacturing.

By **CHAS. W. HARDY**
Industrial Consultant, New York City

THIS expense factor of polishing supplies is important as it generally amounts to a large sum. From an accounting standpoint it should be charged directly to the job or standard cost and *not* included in the department or general burden. Many cost accountants, engineers, certified public accountants and comptrollers will not agree with the statement but the writer has learned during the last twenty years that it is more practical and controllable if excluded from the burden, and charged direct.

When maintained as a separate expense item its weight or value is given much more thought and consideration, and a fluctuation is quickly noticed. It is surprising in case of a change in the foreman how this expense item is increased or lowered; a good foreman is invariably able to lower it. He is interested in seeing this cost lowered and it acts as a "yardstick."

What Are Polishing Supplies?

This classification should include the cost of all items used in the polishing department that are not charged directly to the job. For example, the parts of the articles you make are a direct material item, but buffs, tripoli, lime, etc., cannot be very easily charged direct. Therefore, they are classed as an indirect expense, and customarily included in burden (also called overhead). Some other items of supplies are: felt wheels, emery, greaseless compound, rouge, crocus, pumice, glue, abrasives and gloves used by the employees. It is evident, however, that buffs and wheels are the largest part of this expense.

Charged to Estimates and Costs on a Percentage Basis

A simple method is to determine the cost of these supplies and find their value in proportion to the Department's Direct Labor. For example: the total direct labor of the polishing department for the year is $50,000 and the cost of supplies is $7,500; therefore the percentage is 15% or for every dollar of direct labor you use 15 cents worth of supplies. Here are the actual figures as shown by the payroll and purchase ledger of a large local concern for the last three years.

		SUPPLIES			
Year	Direct Labor	Buffs	Misc.	Total	% to Direct Labor
1936	$28,363	$2,807	$1,895	$4,702	16.6
1935	33,996	4,013	1,997	6,010	17.7
1934	40,749	5,349	2,136	7,485	18.4
Total	$103,108	$12,169	$6,028	$18,197	17.7*

*Actual average for the last three years.

How to Absorb in Estimate or Cost

When compiling an estimate or cost, ascertain the direct labor of the polishing department and then under Materials, show a caption "Polishing Supplies," and add thereto the value of the cost of such supplies. Assume your Direct Labor is $10.00; you, therefore, include under Materials, your supplies cost (say 15%) or $1.50.

To Control Use Monthly Averages

To start, it is best to use a monthly average and after a few months' use, then start a cumulative average and use this figure. The foreman will be much interested if he can get these figures monthly and compare one month with the other.

If supplies are kept in a stock room and perpetual stock records are maintained (see Purchase and Stock Record Control, METAL INDUSTRY, Sept. 1937) it is very easy to determine the cost of supplies requisitioned during the month. If, however, you wish an accurate record, first inventory and price all supplies in the polishing department and use this as an opening inventory figure, and then debit all supplies drawn during the month and then at the end of each month, take another inventory. Credit the amount on hand at the end of the month.

For some concerns this is unnecessary red tape. The foreman will never order anything that he does not absolutely need, near the end of the month; if he does, it will be a very small quantity. Moreover he will watch the various supplies and keep after the men to use sparingly and not to waste.

Direct Labor Classification

Most of us are familiar with the term Direct or Productive Labor, but to elucidate: Direct or Productive Labor is that labor which is done on the product which can be charged directly to the job, such as grinding, polishing, buffing, coloring, etc. Such labor as supervision, sweeping, oiling, timekeeping, etc., is termed Indirect or Non-Productive. If your payroll is not distributed or classified you can easily determine your monthly direct labor by deducting your departmental indirect from the total of the department.

Percentages Used by Firms in the Metal Products Industry

Product	% to Direct Labor
Safety razors, stropping machines	10
Bag, purse and photo frames and novelties	15
Compacts, rouge boxes and lipsticks	20
Cigarette & compact cases	14
Bag & purse frames—ornaments	10
Bag, pocketbook & purse frames, adv. novelties	10
Compacts & rouge boxes	12

Most Concerns Don't Know What Supplies Cost

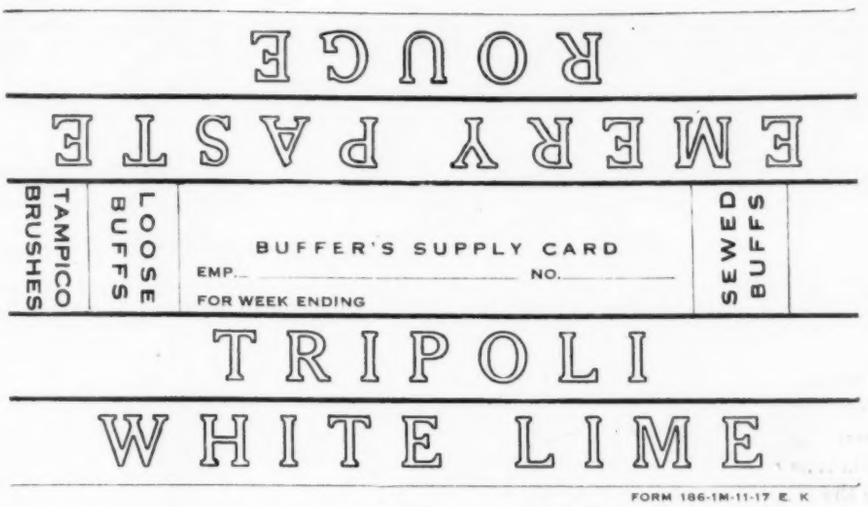
It is surprising to note how few concerns know or seem to care what their supplies cost. They seem to take it for granted that they are necessary and are carefully used, but there is no control or way of knowing whether the cost is low or high. The effort involved in keeping the record is slight and once started, is generally maintained and carefully watched by those concerned. Besides which the employees are more careful in using anything that a record is kept of. There is a feeling on their part that if anything is wasted, stolen, mislaid, etc., it will show in the record and they hesitate. From many years experience the writer has learned that this little "kink" helps a great deal in managing help.

Control of Supplies in the Department

A method that works very well in two medium sized polishing departments is the use of a supply card. One is issued to each polisher every Monday and held until the following Friday night. The Departmental Timekeeper is the custodian of the various supplies. They are kept in a steel cabinet with proper shelf arrangement and under lock at all times. The timekeeper and foreman have a key. When the supply or supplies get low more are requisitioned from the Stores Department.

The polisher to obtain Tripoli, for example, presents the card to the timekeeper with the unused portion, the nib of Tripoli, and obtains a new piece and the timekeeper punches a hole in the card in space printed Tripoli and returns it to the polisher. The nib is retained and placed in a barrel and when filled it is sent to the supplier to be remelted, recast, and returned at a small cost. It is just as good as the new Tripoli. Buffs for cutting down are used to about 7" diameter, then used for coloring to about 5" in diameter, and then sold to manufacturers of silver plated ware at a very fair price.

True, there are loop-holes in this method but under this (and undoubtedly other) methods of stock control the help will be more careful.



Example of a supply card for polishers

Brass Solution

Q.—I am sending you a sample of brass solution. The troubles encountered are fumes coming from the tank while in operation and also the anodes coat over during operation. This tank is used for plating steel solution volume 160 gals.

A.—The analysis of the brass solution submitted is:

Copper	2.46 ozs./gal.
Zinc	.37 ozs./gal.
Free cyanide	2.12 ozs./gal.

Normally the zinc is run at a higher concentration—about 2/3rd oz./gal. However, this would not be the cause of the fumes and the anodes coating over.

Anodes will coat over if the carbonate content of the solution is too high or if the anodes are not of correct chemical or physical composition. The best anodes are composed of 80% copper, 20% zinc, rolled annealed and free from impurities. If this type of anode is not being used it is suggested some be obtained and their operation compared with present anodes.

The fuming can be caused by excessive tank voltage which in turn comes from the anode polarization.

—G. B. H., Jr.

Brownish Bronze

Q.—At one of our plants, the main entrance door is a Calamine door covered with sheet brass. Originally, the brass was finished in a brownish bronze which had fairly well weathered and made an attractive appearance.

However, the door needed considerable repairs and the finish had to be removed for soldering operations, exposing the bare brass. We would like to refinish the door so that it again shows the uniform weathered bronze appearance, and are interested in locating a method and material to achieve this on sheet brass.

A.—The doors are probably made from a low brass and can be colored with a sulphide solution.

Clean the whole door well, removing any oil or other coating.

Then sponge with a sulphide solution, formulas for which can be found in the Platers' Guidebook. One possible formula consists of Liquid Sulphur 1 oz. Water 1 gal. Apply the solution with a sponge. Relieve with steel wool and pumice.

The resulting finish can then be oiled, using a drying oil such as one containing a linseed oil base.

—G. B. H., Jr.

Something New in Silver Plating

Plating silver from a solution containing potassium nitrate at about 16 oz. per gallon.*

By **DONALD WOOD**
Reed and Barton Corporation, Taunton, Mass.

IT IS the purpose of this paper to describe a slight variation of the conventional silver plating solution, which has been in experimental use at Reed and Barton Corporation for about a year. The essential difference between this type of solution and the usual one is that it contains potassium nitrate at a concentration in the order of 16 ounces per gallon. This addition provides the desired conductivity, in the absence of appreciable carbonate. Rather low metal and free cyanide content is possible. The advantages of a potassium solution are available at even less than the cost of the usual sodium solution. And the character of deposit from this solution, especially with carbon disulphide brightener, is superior to that obtained from either the sodium or potassium carbonate solution. Experience with this type of solution covers so short a period that improvement is to be expected; but a typical and satisfactory formula is:

	(avoir)
Silver Nitrate	4 oz./gal.
Sodium Cyanide	4 oz./gal.
Potassium Nitrate	16 oz./gal.

Cost: To allow a comparison of costs, the following formula is calculated to produce a conventional type solution having analysis near the middle of the limits recently prescribed by Mesle:

	(avoir)
Silver Cyanide	5 oz./gal.
Potassium Cyanide	7½ oz./gal.
Potassium Carbonate	4 oz./gal.

On the present market (3/5/37) this solution costs $251.00 per 100 gallons. In comparison, the cost of the potassium nitrate solution is $142.00 per 100 gallons. If the value of the silver is deducted in each case, the resulting net costs are $74.00 per 100 gallons and $30.00 per 100 gallons respectively. Entirely satisfactory results and a further reduction in cost are obtained by dissolving anode scrap to obtain the silver nitrate. Of the $30.00 above, $19.00 is the differential between the cost of silver as metal and as nitrate. This represents no doubt a fair price for the preparation of the usual well-packaged, crystallized, C. P. material. On the other hand, $4.00 of the $19.00 will cover the cost of the commercial nitric acid and the labor required to put the silver in solution. Surprisingly, a stainless steel pail proves very satisfactory as a container for the operation. Excess acid is held to a minimum and this, neutralized with sodium hydroxide. Extreme care is not necessary in this operation, but an appreciable excess of the alkali is undesirable. Using this method the cost drops to $15.00 per 100 gallons if the value of the metal is deducted, or $127.00 per 100 gallons, total cost. The ratio of costs then is about 1 to 2 or 1 to 5 depending upon the method of accounting.

Maintenance and Control

Although no advantage is apparent if a new solution is made with potassium cyanide (but otherwise the same), it is advantageous to compensate for decomposition and drag-out with potassium rather than with sodium cyanide. This is not entirely necessary but a large increase in sodium salts should be and can be avoided in this manner. Carbonate occurs as usual by decomposition of the cyanide. This is held to a small value by precipitation with calcium nitrate. A fertilizer grade, a Norwegian export, and costing about 4 cents per pound is used. Because it is very important not to have an excess of the calcium nitrate left in solution, this precipitation is calculated to leave about .15 N carbonate (1 ounce per gallon as sodium carbonate) in solution. In practice, the dry calcium nitrate is added to the solution which is then vigorously agitated for several hours with a quarter horsepower "Lightning" mixer. Precipitation occurs very nearly at the theoretical rate (1.55 oz. per gallon calcium nitrate to remove .14 N carbonate) (1 oz. per gallon as sodium carbonate). After settling overnight, the solution is pumped off, the tank cleaned and the solution filtered back in.

Control of this type of solution is slightly complicated by the presence of the nitrate. The method used is something of a makeshift but works very well. The usual analyses for silver, free cyanide, and carbonate are made. The nitrate is estimated from a determination of specific resistivity, using a Haring cell. Rough curves such as shown in Figure 1 (page 167) are derived by adding known amounts of potassium nitrate to typical solutions and plotting the measured specific resistivity values against the potassium nitrate concentration. Error will be introduced in this method when any of the other constituents vary from the assumed constants or when impurities have accumulated; but as the potassium nitrate concentration is not critical, the method is adequate.

Where both sodium and potassium salts are present, the concentration of carbonate and free cyanide can not properly be expressed in ounces per gallon. It is found much preferable to consider all determinations in terms of normality.

Operating Notes

With the usual type of agitation and operating between 75 and 80 degrees F. uniform bright plate is obtained on flatware at from 12 to 18 amperes per sq. ft. average, and on hollow-

*From The Monthly Review, of the A .E. S., March, 1938.

ware at from 7 to 10 amperes per sq. ft. average. As with the conventional solution, higher current density is possible, but uniformity of deposit is sacrificed. With this solution the lower limit of uniform bright plate is not so marked as with the conventional solution.

A brighter color is obtainable by reduction of the free cyanide to .15 to .20 N. At this concentration anode polarization may become a problem and no advantage is evident in the finishing of the deposit. If the free cyanide content is increased to about .5 N, a milkier deposit results.

Concentration of silver is best held above .15 N (2 troy ounces per gallon) but little limitation in average current density is evident .13 N (1.75 troy ounces per gallon).

It is suggested that carbonate be removed when the concentration reaches .4 N, a slight change in the character of the deposit becoming apparent at a concentration of about .5 N.

Filtration becomes very important in this type of solution and should be done in the presence of a filter aid of the Diatomaceous type.

Theory

The potassium nitrate solution is the result of a theory on the action of carbon disulphide brightener. It was observed, when brightener was added to a plating solution containing an addition of sodium hydroxide, that a slight precipitation occurred, and that very little brightness could be maintained. This suggested that ordinarily a colloidal precipitate was formed.

Although it was determined that the composition of the observed precipitate varied slightly from that of silver sulphide, it was assumed tentatively that the effect of the brightener was to produce a dispersion of colloidal size particles of silver sulphide in solution. If such particles migrate to the cathode and deposit as sulphide, they should be reduced at once to the metallic state. It appears a reasonable hypothesis that metal resulting from the reduction of sulphide, deposited by cataphoresis, should differ in orientation from that deposited as metal; thus providing the interference with free growth necessary to produce bright plating. If the effect of the brightener is according to this hypothesis it should be possible to vary the rate of migration of the solid phase and thereby the character of the deposit by varying the otherwise neutral ingredients of the solution. A typical example of such a variation would be to substitute all potassium salts for the equivalent sodium salts. To allow observation of the effect of such variations, a series of plant size solutions (300 to 400 gallons) were made and operated over a period of from 3 to 9 months. A wide variety of work was handled through these solutions, current density and temperature relations were observed, and the effect of brightener additions noted. On this scale a very satisfactory comparison was possible in contrast to the fact that only very unsatisfactory comparisons were found possible in the laboratory.

Based on this comparison, the experimental solutions are listed in the order of the brightness found obtainable:

Potassium Nitrate
Potassium Carbonate
Sodium Carbonate
Potassium Chloride
Sodium Hydroxide
Sodium Nitrate
Sodium Chloride

To insure against interpreting, as due to selective absorption, a variation caused possibly by change in conductivity or polarization, extra precautions were taken in the comparison of the potassium nitrate and sodium nitrate solutions. These were first made chemically equivalent. Cathode polarization/current density curves were drawn from measurements in a Haring cell, modified slightly to

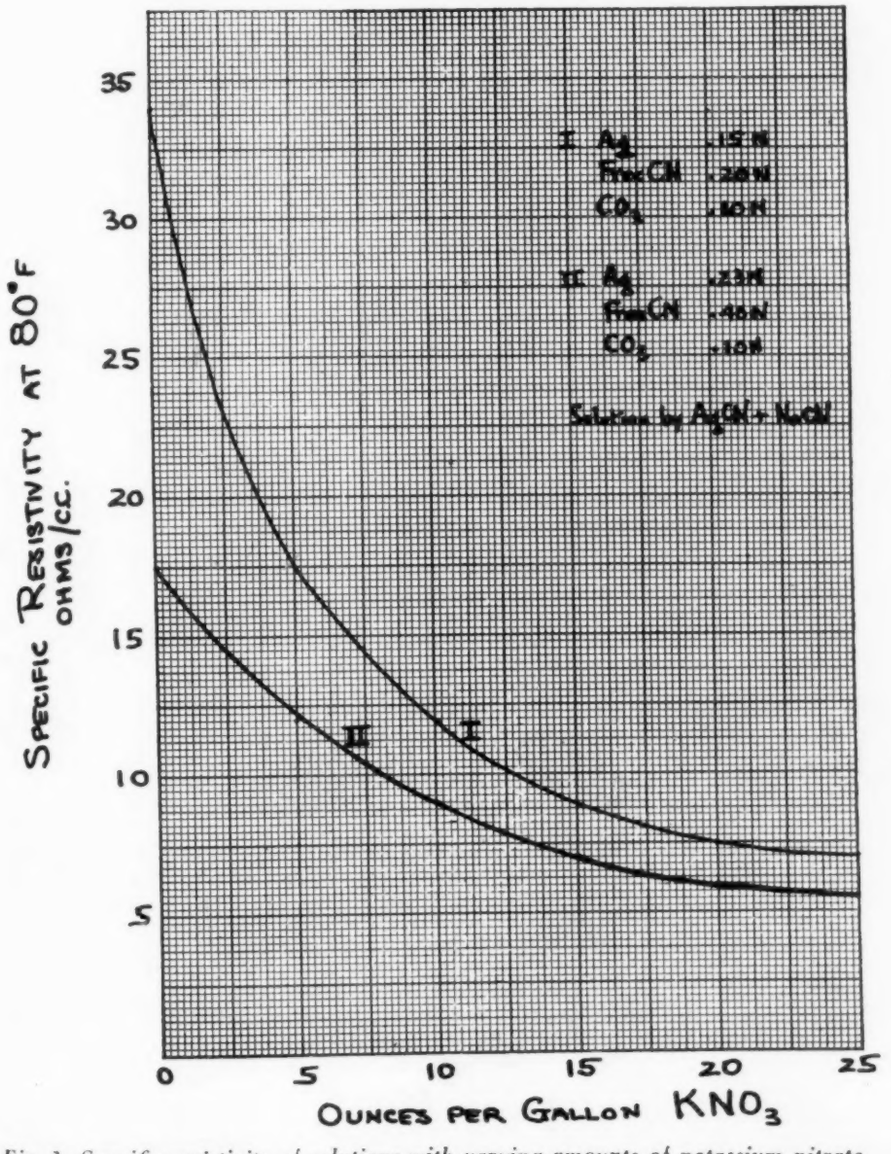


Fig. 1. *Specific resistivity of solutions with varying amounts of potassium nitrate*

allow agitation. These curves were identical and no change occurred when further sodium nitrate was added to make the conductivities equivalent. Operating side by side, chemically and electrochemically equivalent, these solutions had no similarity whatever. The potassium nitrate solution produced lustrous bright deposits over a wide range of operating conditions, and the sodium nitrate solution had so narrow a bright range as to be entirely worthless.

So frequent reference has been made to brightness that an explanation is in order. No matter how bright a silver plate is produced, it is subjected to a buffing operation. For this reason the superficial appearance is of little practical importance. The ease of finishing depends rather on the flatness of the deposit and the absence of texture. A glass-like quality with a milky color is considered preferable to a brighter color with a more crystalline character. Evaluation is easily accomplished by observing the luster obtained by a very soft scratch brushing operation. It is brightness of this nature which has been intended when the word has been used.

It is well known that when carbon disulphide brightener is added to a silver solution, the cathode polarization is decreased. It is not so generally known that the decrease in polarization is of shorter duration than the brightening action. Fig. 2* indicates

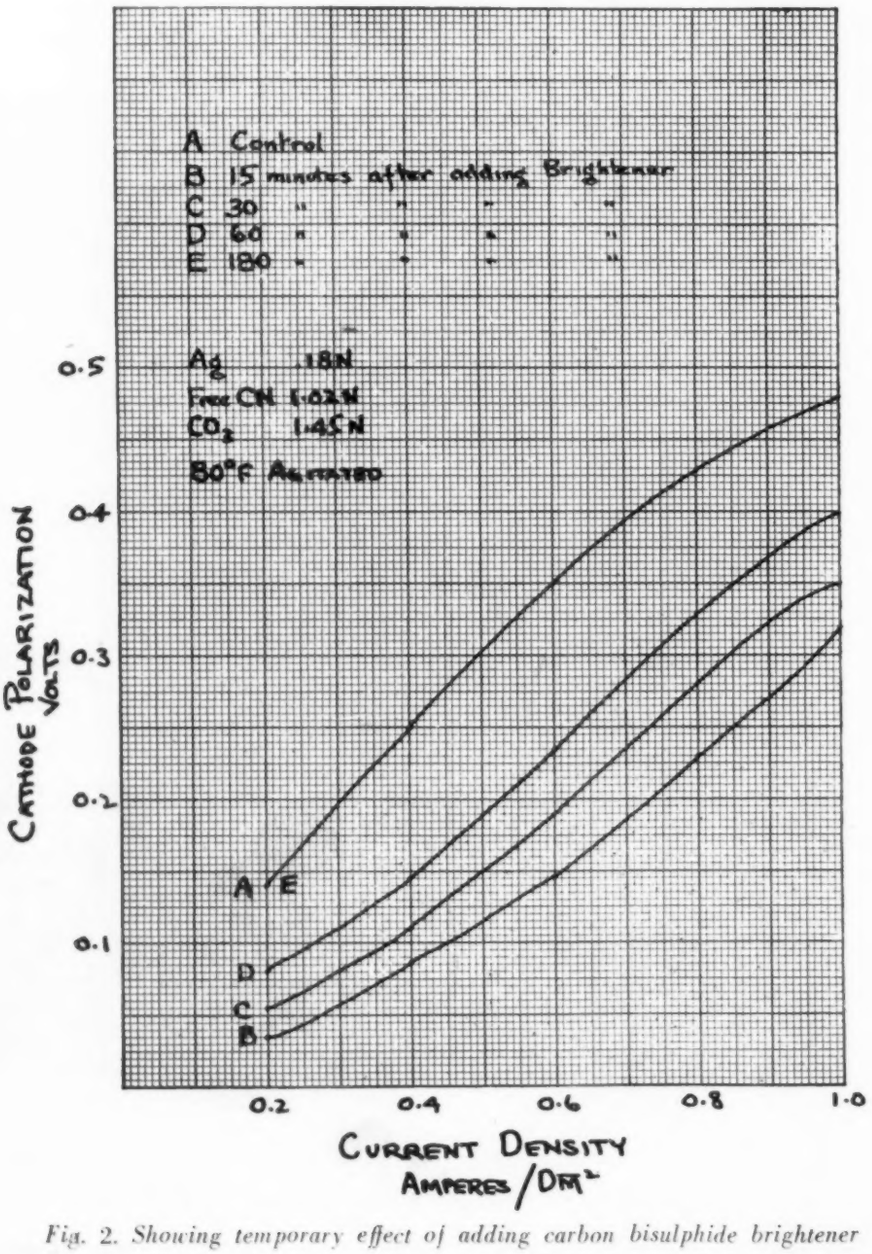


Fig. 2. Showing temporary effect of adding carbon bisulphide brightener

the temporary nature of this effect of the brightener, and is offered in support of the opinion that the two effects of the brightener are independent. Further evidence is found in the fact that a very dilute sodium sulphide solution added as brightener to a conventional solution produces no brightness, but causes a temporary decrease in cathode polarization comparable to that caused by ordinary brightener. Potassium cyanate is observed to act in the same manner. This phenomenon is not understood, but apparently need not be considered as complicating the evidence that a solid colloidal phase is produced.

To avoid digression, it was assumed tentatively that the dispersed material was silver sulphide. Although it appears to differ only slightly from this composition, it is probable that a more complex substance occurs first, which gradually decomposes to the sulphide. Xanthate has been suggested as a fairly satisfactory brightener, and as a possible constituent of the carbon disulphide brightener. Where the brightener is made, using only cyanide solution and carbon disulphide, it is improbable that an Alkyl group could be synthesized. On the other hand, the similar inorganic salt, Thiocarbonate, could undoubtedly occur in the brightener. This material has been prepared and found to act as a brightener. It is stable in the absence of water but decomposes slowly in solution, more slowly if cyanide is present. The silver salt decomposes to form sulphide. Where all the factors are so unstable, no conclusion is to be expected, but it appears reasonably possible that the colloidal material may be a silver Thiocarbonate, Ag_2CS_3 or Ag_2COS_2.

The exact nature of this colloidal material is really of little importance as it is much simpler to make it in the customary empirical manner. The evidence that a solid dispersion occurs and can be controlled to vary the character of a deposit may be of value not only in silver plating but as a possibility in the deposition of other metals as well.

In conclusion, I should like to acknowledge the assistance and collaboration of my assistant, *Mr. John D. MacLean*. I should like also to express thanks to the *Reed and Barton Corporation* for its generosity in allowing publication of this work.

A Study of the Rochelle Salt-Copper Plating Bath

Part VI. Conclusion; a summary of the entire series.*

By A. KENNETH GRAHAM[1] and HAROLD J. READ[2]

1—A satisfactory Rochelle salt-copper plating bath composition is as follows:

	Average Composition oz./gal.	*Approximate Limits oz./gal.*
Metallic copper	2.5	2- 4
Copper cyanide	3.5	3-6
Sodium cyanide (total)	4.6	4- 7
As free cyanide	0.75	0.5- 1.0
Rochelle-salt	8.0	6- 8
Sodium carbonate	4.0	2- 8
Sodium hydroxide needed for a pH of about	12.6	12.2-12.8

2—Baths with the lower metal content give brighter deposits but lower efficiencies at both anode and cathode.

3—The free cyanide should be closely controlled, within the limits indicated by frequent chemical analyses for uniform results.

4—A Rochelle salt concentration of from 6 to 8 oz./gal. is satisfactory. This constituent is lost chiefly by drag out. The analyses, therefore, should be frequent enough to maintain the concentration within the desired limits. Such analyses must be done by an experienced chemist as the procedure is not simple.

5—Some carbonates must be present to reduce anode polarization, to improve the pH control and to prevent attack of iron in contact with the plating bath. Since carbonates will tend to build up in the bath an initial concentration of 4 oz./gal. is satisfactory.

6—A pH of from 12.2 to 12.8 will give good results. The lower value will be more difficult to maintain because of the poor buffer characteristics of the bath below 12.2. In practice it is safer to maintain an average pH of 12.6. Too high a pH must be avoided as the anode efficiency may be prohibitively low. A buffer curve will assist one in estimating the required additions of sodium hydroxide when adjusting the pH. If the pH should be above 12.8, an addition of sulphuric acid in small amounts with thorough agitation of the bath will lower it. *Care must be taken to have adequate ventilation and to avoid inhaling the poisonous cyanide fumes while making such an adjustment.*

Optimum Condition of Operation

7—A temperature of 130°F to 190°F may be employed. The higher the temperature the more rapid will be the decomposition of free cyanide and build up of carbonates. Higher temperatures also give higher efficiencies at both anode and cathode. A temperature between 140° and 160°F is favored. The value chosen should be controlled within about 10°F for uniform results.

8—Agitation is recommended. While the degree of agitation will vary greatly in different installations, its qualitative effects should be recognized. Its use will result in higher efficiencies, more uniform bath composition, more uniform anode behavior and a shifting of the current density range within which the brightest deposits are obtained.

9—Cathode current densities as high as 90 a/sf are possible without agitation of the bath. The brightest deposits are obtained between 20 and 60 a/sf depending upon the temperature and agitation employed.

10—The cathode efficiency for current densities of 20 and 60 a/sf, with no bath agitation, may vary between 60% and 30% at 130°F and between 73% and 43% at 160°F for the bath mentioned above. Agitation of the bath will raise these values somewhat.

11—The anode current density must be carefully controlled. A safe recommendation would be to have an anode area equal to twice the cathode area and to have iron anodes equivalent to about 5% of the anode area. The current density at the anode will then be considerably lower than at the cathode. Furthermore, the iron anode will tend to prevent excessive polarization of the anodes. If the metal concentration of the bath builds up, the proportion of insoluble iron anodes can be increased. If, on the other hand, higher anode efficiencies are obtained through the use of high temperatures and agitation, less anode area may be used. The criteria by which one can judge is to observe whether the metal concentration of the bath is maintained reasonably constant and to note whether excessive anode polarization or bath voltages are avoided. Rapid pH changes may also be an indication of unsatisfactory anode conditions.

12—Assuming that the operating conditions chosen for the recommended bath are a temperature of 160°F and a cathode current density of 40 a/sf, the cathode efficiency will be approximately 50%. To deposit a thickness of 0.0003 inch at a current density of 40 a/sf will require approximately eight (8) minutes. This is the same rate of deposition as would be possible from an acid copper bath operating at 40 a/sf and an efficiency of 100%.

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*Parts I-V were published in Metal Industry for November and December, 1937; January, February and March, 1938.

The pH of Alkaline Plating Solutions

All plating solutions, both acid and alkaline, should be operated under pH control. Conclusion.*

By **GEORGE B. HOGABOOM**

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Brass Solutions

This proved to be the most interesting solution studied. The results that were obtained were unexpected. None of the other solutions run were as susceptible to changes in the pH value. Springer noticed a change in the color of the brass deposit obtained when a solution was operated at different pH values. The solution he used had a different composition from the one run in this research. He added the zinc as a chloride and also made additions of ammonium chloride to the solution. There is the probability that some of the "spotty and non-uniform" deposits were due to the presence of a chloride in the solution. Addicks, in the discussion of the cause of "spotting-out" of electroplated coatings, stated (Transactions Electrochemical Society, Vol. 29, p. 376, 1916) that copper solutions containing a chloride are sensitive to light. He said, "In the work I had done in the plating copper out of copper solutions, where chlorine was present, some cuprous chloride comes down at the cathode; the cathode looks normal in the solution, but by putting it in the sun with anything placed over it, it will take a print of the object, in a few minutes. In the cyanide solution these chlorides would be in solution, but when you wash such a cathode some of the chloride may be precipitated and show nothing at the time, but the next day all of this blackening appears." It would seem from Addicks' experience that the addition of a chloride to a solution containing copper is not advisable. This may be a contributing factor in "stain" spotting-out.

There is a difference in the color of the brass deposits obtained in this work when a solution was operated at the same pH value as Springer used. From pH 9.8 to 10.3 his deposits "came out a beautiful brassy yellow." Coats obtained a greenish yellow between pH 10.1 and 12.1. He had a metal ratio of about 70% copper and 30% zinc in both the solution and the anodes. In this work in which the solution and the anodes were 80% copper and 20% zinc, the color of the deposit obtained between pH 8.2 and 10.2 had a reddish color. At pH 10.6 it was greenish yellow but at 11.0 to 11.8 the color was again reddish. The best color was had at pH 12.2, while above that pH the color was not so good.

The color of brass is due to its copper-zinc ratio. The deposits from the solution run warm ware assayed, and Coats' statement that those containing over 40% and under 20% zinc were red in color, was confirmed. The only yellow brass color obtained was when the deposits contained 80% copper and 20% zinc, i.e., a color that would match a fabricated piece of high brass.

That the copper-zinc ratio of the deposit from an 80-20 brass solution run warm with 80-20 anodes was radically affected by the pH value of the solution, was proved. At pH 8.2 the deposit contains 98% copper and 2% zinc; at 10.6—65% copper and 35% zinc; at 12.2—80% copper and 20% zinc; and 13.4—45% copper and 55% zinc. This apparently indicates why so many times the desired color could not be had even when the solution has the correct composition. (Fig. 6—Table VI).

Table VI—Brass (Cold)

FORMULA:	Copper Cyanide	—3.6 oz./gal.
	Zinc Cyanide	—1.2 "
	Sodium Cyanide	—7.5 "
	Soda Ash	—4.0 "
	Ammonia	—0.16 "
TEMP.:	70°F.	
C. D.:	5 amp./ft.²	
TIME:	1 Hour	
ANODES:	Brass—80:20	

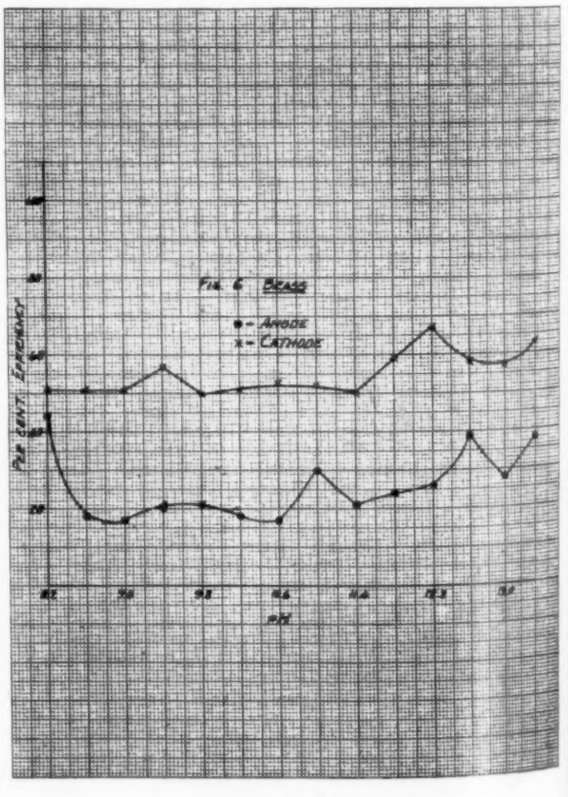


Fig. 6. Brass

*A paper read at the New York Convention of the American Electro-Platers' Society. This paper won the Proctor Memorial Award. Part 1 was published in our March issue.

pH	Cathode Composition % Copper	% Zinc	Anode Efficiency —%	Cathode Efficiency —%
8.2	91.0	9.0	44.4	51.3
8.6	89.8	10.2	17.6	50.3
9.0	88.5	11.5	16.4	50.7
9.4	80.2	19.8	20.2	57.4
9.8	88.6	11.4	21.2	49.8
10.2	80.6	19.4	17.7	50.2
10.6	73.3	26.7	17.0	52.7
11.0	...	...	30.1	...
11.4	73.7	26.3	21.3	48.9
11.8	74.8	25.2	24.0	58.8
12.2	58.7	41.3	26.3	67.5
12.6	64.3	35.7	39.1	58.0
13.0	52.7	47.3	28.3	56.0
13.4	48.2	51.8	38.2	63.6

When the pH of a brass solution is above 13.6 it may refuse to plate. The addition of an acid salt, e.g., sodium bicarbonate, will correct the pH and the solution will function at once. This condition has been seen when the chemical composition of the solution was as near a standard condition as could be made. Some acid salts have very little effect on the pH of an alkaline plating solution. Sodium bisulphite added up to six ounces per gallon to a brass solution only changes the pH value from 10.3 to 10.1. Sodium bisulphate has a greater effect, but it is not known what effect the sodium sulphate remaining has upon the solution.

To obtain further data a "warm" and a "cold" solution were run, and the anode and cathode efficiencies compared. In a warm solution the cathode efficiency ranged from 31.6% to 54.9%; in the cold solution, from 49.8% to 67.5%. There is marked difference in the anodes efficiencies. In the cold solution they were from 17% to 44%; in the warm solution, from 47.2% to 142.7%. When the ratio of the copper and zinc in the cathode is taken into consideration, the latter figure is not surprising, as where the copper content is high in a very alkaline solution, pH 13.4, the anodes were badly coated. It was at that pH that the anodes in a copper cyanide solution took on a green coating (Fig. 7, Table VII).

The anode and cathode efficiencies of a cold and a warm solution was determined. (Fig. 8—see page 172). Those that were nearest the same were obtained when the solution had a pH value of 12.2 and the copper-zinc ratio of the cathode was 80-20. The anode efficiency in the warm solution was 62.1%; the cathode, 67.5%.

Table VII—Brass (Warm)

FORMULA:	Copper Cyanide	—3.6 oz./gal.
	Zinc Cyanide	—1.2 "
	Sodium Cyanide	—7.5 "
	Soda Ash	—4.0 "
	Ammonia	—0.16 "
TEMP.:	105°F.	
C. D.:	5 amp./ft.²	
TIME:	1 Hour	
ANODES:	Brass—80:20	

pH	Cathode Composition % Copper	% Zinc	Anode Efficiency —%	Cathode Efficiency —%
8.2	97.3	2.7	100.8	47.2
8.6	96.0	4.0	119.0	43.7
9.0	95.2	4.8	124.5	43.4
9.4	89.2	10.8	73.0	45.2
9.8	92.0	8.0	92.9	43.3
10.2	85.4	14.6	90.3	38.8
10.6	64.4	35.6	57.7	47.3
11.0	89.5	10.5	76.3	46.4
11.4	89.8	10.2	99.0	40.7
11.8	93.1	6.9	82.4	54.9
12.2	80.4	19.6	62.1	53.1
12.6	51.4	48.6	47.2	31.6
13.0	56.2	43.8	98.3	39.9
13.4	44.2	55.8	142.7	34.7

The study of the pH of alkaline plating solutions has proved most interesting. This research can be considered exploratory. Further investigation should be made of each solution so as to obtain the optimum plating conditions. It will be found that in a brass solution the optimum pH value will depend upon the metal concentration, the temperature of operation, the copper-zinc ratio of the anode and the solution and the effect of addition agents, as the color of the deposited metal is a yard-stick by which the results are measured. The influence of temperature is indicated by the color of the deposit from the cold and warm solution. The deposit from a cold solution run at pH 13.4 is the same in color as that obtained at pH 12.2 in a warm solution, although the copper-zinc ratio is different. This may be due to crystal size and orientation.

There is also evidence that blisters and peeling of deposits from any alkaline plating solution may be due to its pH value rather than entirely to cleaning. In a brass solution the steel plates run at pH 10.6 blistered every time, until very heavy etching of the steel was resorted to, which probably gave an anchorage and not a true bonding. This pH value, 10.6, seems to be a critical point of operation. The color and character of the deposit and the copper-zinc ratio is distinctly different from those preceding or following this pH value.

This work would not be complete without determining the effect the pH of a solution has on the structure of the deposit. Those from cyanide copper and those from cyanide copper and rochelle salts solutions at pH of 8.2 for low and 13.4 for high, indicate that the crystal structure is affected by the pH. (See Figs. 9 and 10, page 173).

The only conclusion that can be drawn is that all plating solutions, both acid and alkaline, should be operated under pH control.

Discussion

Chairman Servis: You have heard this very interesting paper by Mr.

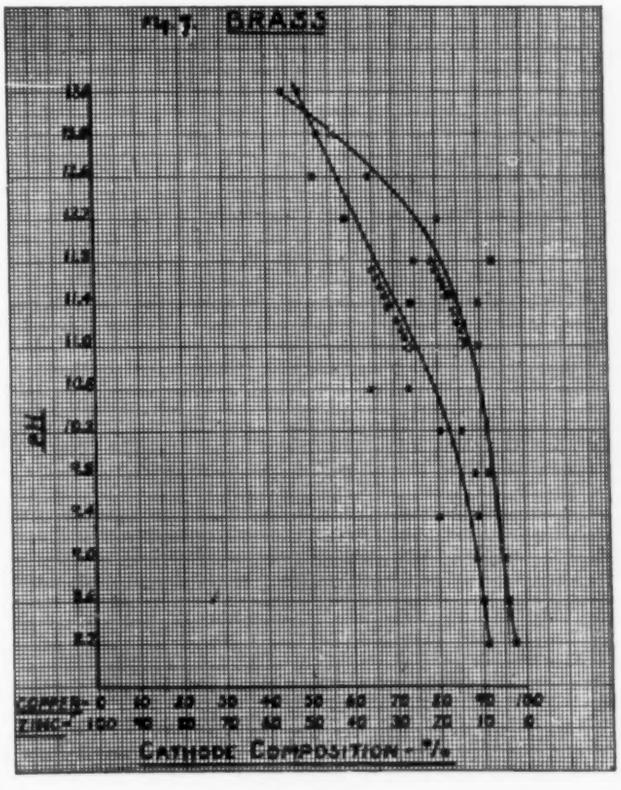


Fig. 7. Brass

Hogaboom, and I assume there are quite a number of questions to be asked.

C. J. Wernlund: I should like to ask Mr. Hogaboom what current densities were used on the current efficiency curves on the copper.

Mr. Hogaboom: About fifteen amperes.

Mr. Wernlund: On the brass it was five?

Mr. Hogaboom: Yes.

R. Olsen: Would there be any difference in plating zinc die castings in a pH range which had a little trouble in blistering on zinc? We checked our cleaning thoroughly and we did not have any trouble in plating steel or brass or copper, but we did have a little trouble with little, fine blisters in plating zinc base die castings.

Mr. Hogaboom: Of course, there is a difference in voltage, and there would probably be a difference in effect in the current used. As to the pH value of zinc, I think we may anticipate a paper to be published, I believe during this coming year, on zinc die castings. I believe one of the greatest causes of blistering of zinc base die castings is something that may be called a skin that is on the die castings. Recently, in operating die castings in which the casting was plated in a copper solution, blistering occurred. It was found that by dipping the work into a fifteen per cent hydrochloric acid before buffing that the blistering entirely disappeared.

What brought about that suggestion, if I may speak about the zinc-aluminum-mercury anode, was when that anode is put into the solution at first it has a very dark color, and about two or three days later it will brighten up and will stay bright. That dark color is due to a film that is on the anode. That film is very valuable, because it prevents mercury from sweating out while the anode is in stock, but just as soon as that film is off, the mercury will sweat out in normal temperatures.

There is some work being done on that subject. This skin has a materially different composition and different physical characteristics than the body of the basis metal. I think that is the cause of the blistering of die castings rather than the cleaning or the solutions.

F. J. Hanlon: Mr. Hogaboom, just a little addition to what you said relative to the skin on die castings. As you know, for many years we have done nothing except plating die castings, and recently we have run into some of this difficulty of which you speak. On investigation we find that a great deal of the blistering is caused by the treatment of the dies before the castings are made. Heretofore, in the manufacture of die castings the operators, in their endeavor to make die castings fast and keep the dies from plugging up, have been using a solution of caustic soda which, after the die has been in use for several years, permeates the die and, under the pressure of the hydraulic machines, a little of it is forced to the surface, and unless the surface is washed thoroughly and baked before prepared for plating, you have difficulty.

Some bright scholar decided that an oxide of zinc solution rubbed into some of those dies, or washed on the dies before and after several shots of metal, would be of great assistance. When it comes out the casting is warm and it is hung up and usually baked, and that comes on the outside and has given a lot of people the mistaken idea that it is a skin. In reality it is a sort of chemical shield to the casting, and it was not really intended as such; it was just to clean the die.

Mr. Hogaboom: I am very thankful to Frank for telling us about that. It has been noted that some die castings will work perfectly, while other die castings will work very badly.

Mr. Soderberg: I want to point out, following Mr. Hogaboom's example, starting with nickel, that for quite some time we were limited to a very narrow range of pH. Today we do not feel so limited, as you know. All bright nickel solutions are operated outside what was originally considered the best pH range. We have the problem not only of precipitation of hydroxide of nickel, but also precipitation of impurities.

Now in your paper I notice some peculiar conditions in that in some cases a pH change had no effect on efficiencies—no apparent effect—and I am wondering if it is not all a question of small amounts of impurities, and whether or not, in the future work, we will be following Mr. Meyer's very good expression, "It is necessary to control those impurities."

I would suggest that one should start out with as pure chemicals as are possible to obtain—you might have to make them yourselves. In some of our work we have to make up pure chemicals ourselves, then start getting analyses of the materials available commercially. Then add those materials, each one at a time, in increasing amounts. I believe we are going to find, when we get all through, that in many cases we can plate from cyanide solutions over a very wide pH range; if we have pure materials present in the bath that is going to decide what pH range we can operate. That means, probably,

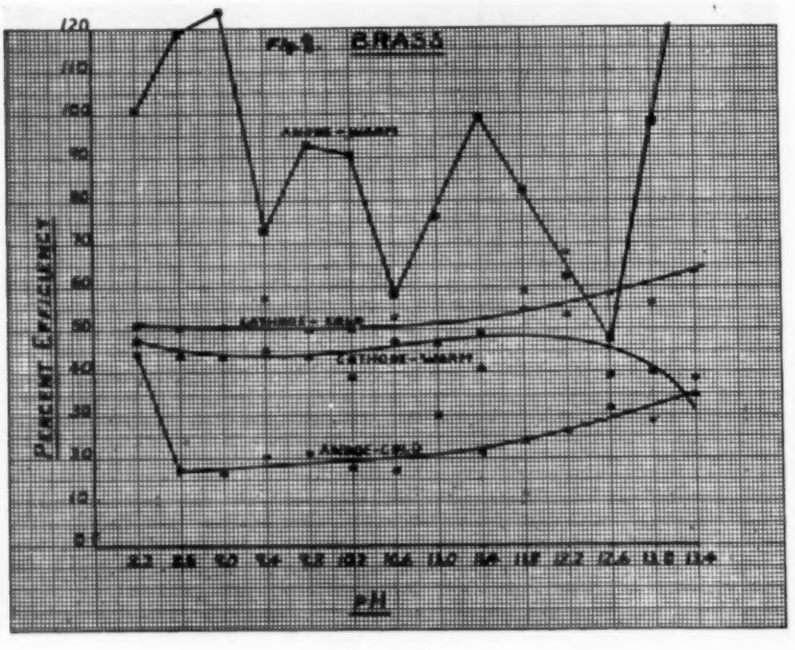


Fig. 8. Brass

that the purity content of our solution will vary. We are not always operating the same solution at the same pH one year as the next year.

Mr. Hogaboom: What Dr. Soderberg said is correct. We should study that point. There is another point that we should study, that Mr. Meyer did not cover, and that is the effect of colloids. You probably know that in copper refining, glue is commonly used as an addition agent. It is very expensive; the glue lasts only twenty-four hours. If they used gulac the effect is quite constant. In the copper elcctrolyte there is some arsenic; with the use of glue there is practically no arsenic in the deposit; with the use of gulac the content of arsenic is very high, so high that it ruins the copper. We not only have the effect of small metallic impurities, as Mr. Meyer and Mr. Soderberg have brought out, but we also have many other things.

Dr. Blum: Some more unsolved problems. This work is really opening an entirely new field, and it is rather strange that so little attention has been given to the pH of alkaline solutions in the face of its recognized importance in acid solutions. One reason, I think we can safely say, is that in the first place the alkaline solutions are so much more complicated, not only in the number of things added, but in the number of compounds that may be present in these solutions. In the second place, the actual hydrogen ion content of all of these solutions, when you have a pH of 10 or of 13, is so small that you would not anticipate as great an effect as you would on the other side, where the difference in pH represents a relatively large amount of hydrogen ions which might be discharged along with the metal.

A suggestion I have to make on the research is to extend and correlate these experiences with those acid solutions.

If you have a solution of pure nickel sulphate, it is in equilibrium with nickel hydroxide at a pH of, say, about 6.8. In other words, if you get the bath more alkaline than that, you will precipitate the nickel hydroxide. It is no coincidence that nobody tried to run a nickel-plating solution at a pH above 6.8, because then precipitates form unless enough ammonia is added to raise the pH up to 8, when a different series of compounds is formed.

pH 8.2 *pH* 13.4

Fig. 9. Cyanide Copper × 500

pH 8.2 *pH* 13.4

Fig. 10. Cyanide Copper + Rochelle Salts × 500

What is the pH of a pure silver cyanide solution? I am just guessing it would probably be about 8.5. Mr. Soderberg touched upon wide ranges. It is rather interesting that we started out on nickel plating and said that it was necessary to keep a very narrow range, between 5.5 and 5.8, or something like that. Then Bill Phillips and some other people came along and, instead of changing the pH a little bit, they dumped in a lot of acid and went to the other extreme and found there is another range. Nobody can explain why the best pH ranges for nickel plating are separated by a less favorable range.

I am bringing that in to show you that in cyanide solutions, there may be one range in which one form of solution works, and another range for another solution. I am not giving you any answers; I am just giving you problems.

Mr. Hogaboom: If I may comment on Dr. Blum's statement about pH in the nickel solution, if a nickel solution is run at pH 5.0 you will find that the coating over the anode is black, which will assay around 13% nickel oxide and nickel peroxide. If you get it down to a pH of 3.0, you will have a coating of about 35% nickel oxide and peroxide. When you get it into the high acid range, e.g., pH 1.5-2.0, the nickel oxide and nickel peroxide is taken into solution as fast as it is formed, and that is the advantage.

Copper Under Nickel

Q.—Do you recommend copper flashing before nickel platings? Is it a fact that copper before nickel will prevent a good amount of pitting?

A.—Copper flashing is still considered of value in plating work that has a type of surface which would be difficult to cover with nickel direct. Such work as iron castings, bronze or brass castings, refinished work, and other material with an irregular surface comes in this category. If pitting is coming from the nickel solution copper flash plating may reduce but will not eliminate pitting. Pitting can be eliminated by the use of peroxide or a wetting agent in the nickel solution.—T. H. C.

Methods of Joining Copper Alloy Products. Part 5: Sheets.

Welding methods have become vitally necessary (a) as an element in facilitating design, (b) as an economical manufacturing method, (c) as an aid to good service performance and (d) as a convenient means of making repairs. Examples are taken and analyzed to help the designer, shop superintendent and welding operator to a better understanding of the problems involved.*

By **I. T. HOOK**

Research Engineer, The American Brass Company, Waterbury, Connecticut

IN PARTS 1 and 4, the various methods of joining copper alloy tubes were discussed. In Part 6, the joining of copper alloy *sheets* is taken up. In general, copper or a copper alloy is required by reason of its electrical, chemical, mechanical or aesthetic properties. But once decided upon, the fabricator's principal interest lies in its hot and cold workability and methods by means of which sheets and structural parts can be joined. In this discussion, we are concerned principally with such methods with special emphasis on welding. The intent is to furnish a rational basis for design of copper alloy containers and structures.

Methods Discussed

Copper alloy sheets can be bent, folded, drawn shaped and connected by any of the methods familiar to the sheet metal trade. Of the various possible methods of connecting copper alloy sheets, mechanical methods as (a) lock seaming and (b) riveting are discussed briefly while metallurgical methods as (c) soft soldering (d) brazing and silver brazing and (e) fusion welding are considered in greater detail.

Lock Seaming

Perhaps the simplest method of connecting copper and copper alloy sheets applicable for the most part to thicknesses of 1/16" and under, though occasionally employed on sheets as thick as .109", are the single and double lock seams illustrated in Figures 13(a) and (b) respectively. In containers for liquids or for light pressures, such seams are often strengthened and sealed with soft solder. The solder is more useful as a sealing agent than as a strengthening factor. A pull upon this type of joint tends to unfold it. Hence the solder bond is subject to a tearing action which type of stress it is least able to resist. There is some gain in strength if the joint is thoroughly sweated with the soft solder with a good fillet on both sides.

In situations where the joint may be subject to galvanic corrosion, the soldered area should be restricted as closely as possible to the joint itself in order to minimize this effect. A high tin solder is more subject to this galvanic-corrosion attack than is a high lead solder. Soft solders having less than 40% of tin are not greatly affected and from this standpoint are more satisfactorily than the 50:50 lead-tin solder or the 95 tin 5 antimony solder. Soft solder containing 50% lead 50% tin is usually satisfactory for sealing tank seams.

Silver solders or brazing alloys are not often recommended or used for this purpose as the temperature of application would make the seam dead soft. No small part of the strength of a locked seam joint is due to the beneficial effect of the cold bends and hammering or pressing of the seam. This hardening effect is lost if the flattened seam is annealed by the heat of the soldering operation.

In some cases where expansion and contraction are an item, the straight mechanical lock is preferred. The copper roofing for residences is a case in point. Though secured to the wooden sheathing by means of special copper nailing cleats, each sheet or "roof-pan" is free to follow the temperature while the shrinking and warping of the pine sheathing causes no undue buckling or strain in the copper. Figure 13(c) illustrates a double locked standing seam for this type of roofing.

Riveted Copper Alloy Vessels

A great many small containers have been made up of riveted copper or brass and a number of larger pressure vessels of riveted copper or "Everdur Silicon Bronze" but little if anything has been published to help the designer in planning a riveted copper alloy vessel. A research on this subject for copper and "Everdur Silicon

(a) Single lock. (b) Double lock. (c) Double lock on a standing seam.

Figure 13. *Locked seams (before being pressed or hammered flat) as used in thin sheet metal.*

*Parts 1, 2, 3 and 4 were published in our issues for Sept., Oct., Nov., 1937, and Jan., 1938.—Ed.

Bronze" showed the following fundamental design to be nearly correct. Several pressure vessels have been designed on this basis and have subsequently given satisfacory service. The values given below for ultimate strength must be divided by an appropriate factor of safety when applied to a given design. Thus:—

TABLE 5. Design Data for Riveted Construction

Material	*Remarks*	*Ult. Str. PSI*
Soft Copper Rivets	In single shear.	20000
Copper Rivets	In bearing in hot rolled or annealed copper sheets—on projected area.	40000
Copper Sheet	Tearing or tension of hot rolled or annealed sheet.	30000
Hot Pressed "Everdur Silicon Bronze" Rivets	In single shear.	40000
"Everdur Silicon Bronze" Rivets	In bearing on the projected area in hot rolled or annealed "Everdur Silicon Bronze" sheets.	85000
"Everdur Silicon Bronze" Sheets	Tearing or tension of hot rolled or annealed sheet.	54000

If copper rivets are set cold with sufficient upsetting to cold work the copper an amount equivalent to commercially hard copper, an ultimate shearing strength of 28,000 pounds per square inch may be used. Similarly, if the copper sheet is cold rolled to show a tensile strength of not less than 40,000 pounds per square inch, the unit value for tearing of the sheet may be taken as 40,000 pounds per square inch and the unit value in bearing on the projected area at 60,000 pounds per square inch.

Copper rivets may be set hot or cold. "Everdur Silicon Bronze" rivets in the smaller sizes can be cold headed but in the larger sizes as ½", ⅝" and ¾" diameter must be placed hot—the rivet being heated to a very dull red approximating 1100°F to 1300°F.

In general, the design of a riveted joint in copper or "Everdur Silicon Bronze" based on the above data is quite similar to a connection in steel but the rivets are smaller and more numerous.

Riveted copper and "Everdur Silicon Bronze" vessels cannot be caulked tight as readily as is the case with steel vessels. The lower modulus of elasticity and yield point of the former make this method of closing a leaky riveted seam unsatisfactory.

Moreover, the copper alloys do not corrode tight as is the case with the ferrous metals. They must, therefore, be made permanently tight in the first place.

Soft solder is often used to seal and strengthen riveted lap seams in thin brass and copper vessels. As was pointed out in the case of the locked seams, the use of soft solder is advantageous in that the cold work strength of the sheet and rivets can be retained by its use. Soft solder is sometimes used as a seal for seams in copper range boilers but it is impractical for large vessels made of thick sheet. This being the case, most large copper and copper alloy vessels have been made by welding or brazing rather than riveting.

Copper Alloy Sheets

A great variety of copper alloys can be made in sheet form. Table 6 is by no means a complete list but is fairly representative of the alloys available commercially.

In selecting the alloy from Table 6 to use in a certain piece of equipment, the designer will find the values for strength and conductivity useful. On the other hand, it is probable that he will be governed more by such other factors as corrosion resistance and cost. Neither of these can be dealt with in this discussion.

He should, however, give some consideration to the possible methods of fabrication. The columns on Weldability Ratings give a rough indication of what may be expected in attempting to make up the assembly by welding. In the discussion to follow, the reasons for rating the weldability of the various sheets will become apparent. As will be seen, the difficulties are not, in every case, the same.

Welding Rods

A variety of copper alloys are available in welding rod sizes. Table 7 (p. 176) gives a partial list of bare welding rods that are available commercially.

Table 6. Properties of Copper Alloy Sheets**

	Tensile Strength PSI		*Melting Point Degrees*		*Conductivity* %*		*Weldability Rating△*		
Name	*Soft*	*Hard Temper*	*C*	*F*	*Electrical*	*Thermal*	*Resistance*	*Oxy-acetylene*	*Elec. Arc*
Copper	33000	47000	1083	1981	100	100	D	C	C
Deoxidized Copper	35000	50000	1083	1981	85	88	D	B	B
Commercial Bronze 95%	36000	55000	1065	1949	55	62	D	B	B
Commercial Bronze 90%	37000	62000	1045	1913	41	48	D	B	B
Red Brass 85%	40000	65000	1020	1868	37	41	D	B	B
Red Brass 80%	43000	72000	1000	1832	31	36	C	B	C
Spring Brass	47000	76000	965	1769	28	32	B	B	D
Yellow Brass	45000	76000	930	1706	26	31	B	B	D
Muntz Metal	57000	82000	905	1661	28	32	C	C	D
Silicon Red Brass 1029	57000	85000	990	1814	14.3	17	A	B	B
"Everdur Silicon Bronze" 1010	55000	92000	1019	1866	6.7	8.5	A	A	A
18% Nickel Silver 719	58000	85000	1110	2030	5.9	8.7	A	C	D
Ambrac	50000	80000	1150	2102	6.2	10	A	C	C
Super Nickel	50000	72000	1225	2237	4.8	7.5	A	B	B
Phosphor Bronze Grade A	50000	80000	1050	1922	18	21	B	D	B
Phosphor Bronze Grade C	55000	92000	1025	1877	13	16	B	C	B
Ambraloy 901	52000	95000	1060	1940	17.7	21	B	D	C
Beryllium Copper	70000	193000[m]	955	1751	18-25[k]	22-27[k]	B	D	C

**The values given are average values and must not be used for specification purposes. Variations therefrom must be expected in practice.

*Electrical conductivity of the soft metal in percent of I.A.C.S. at 20°C. Thermal conductivity of given alloy in percent of that of copper at 20°C. Value for copper being taken as .923 Cal/sq. cm/cm/sec/Deg. C at 20°C.

△A—Excellent, B—Good, C—Fair, D—Difficult.

[m] Heat treated after cold working. Beryllium copper heat-treated after annealing and quenching has strength of 175,000 pounds per square inch.

[k] Varies with the heat treatment.

Table 7. Copper Alloy Welding Rods

Name of Alloy	*Melting Point Deg. F.*	*Approximate Composition Percent*	*Suggested welding method, appropriate base metal, remarks*
Electrolytic Copper	1981	99.9 Copper .03 to .07 oxygen	For copper-hydrogen brazing of steel.
Deoxidized Copper	1981	99.9 Copper, Deoxidizer present, no oxygen	Oxy-acetylene welding of copper.
Silicon Copper	1981	99.7 Copper .25 Silcon	Oxy-acetylene welding of copper or thin sheet steel.
Tobin Bronze	1625	59 Copper .50 Tin, Rem. Zinc	Oxy-acetylene welding of copper alloys, nickel alloys, steel, cast iron, malleable iron.
520 Manganese Brass	1625	58 Copper Manganese present, Rem. Zinc	Oxy-acetylene welding of extruded alloys and steel.
Manganese Bronze	1598	Copper, Tin, Iron, Manganese Zinc	Oxy-acetylene welding of copper alloys, steel, cast and malleable iron. Wear resistant surfacing on copper alloys, steel and cast iron.
Anaconda (Low Fuming) Bronze 997	1598	Licensed under U. S. Patents RE 17631 & 1,525,058	Oxy-acetylene welding of copper alloys, nickel alloys, steel, cast iron, malleable cast iron.
"Everdur Silicon Bronze"	1866	96 Copper, 3 Silicon, 1 Manganese	Oxy-acetylene welding, carbon arc welding, metallic arc welding, of copper alloys. And special applications to steel.
Phos. Bronze A	1922	4 Tin, .25 P, Rem. Copper	Carbon or metallic arc welding of copper, bronze, brass and steel. Also wear resisting coatings.
Phos. Bronze C	1877	8 Tin, .09 P, Rem. Copper	Carbon or metallic arc or oxy-acetylene welding of bronze, brass, steel. Coated electrodes.
Phos. Bronze D	1832	10 Tin, .25 P, Rem. Copper	Long carbon arc welding of copper and bronze. Wear resisting surfaces on steel and cast iron. Harder than Phos. Bronze A.
Nickel Silver	1931	55 Copper, 18 Nickel Rem. Zinc	Oxy-acetylene welding of nickel silver.
Super Nickel	2237	30 Nickel, Deoxidizer present, Rem. Copper	Oxy-acetylene welding of cupro-nickel, steel. Flux coated metallic arc welding.
Aluminum Bronze	1904	8 Aluminum Rem. Copper	Carbon arc welding of aluminum bronze.
Beryllium Copper	1751	2.75 Beryllium Nickel present Rem. Copper	Carbon arc welding of beryillium copper. Wear resisting surfaces.

This series will be continued in an early issue.—Ed.

Cadmium Solution

Q.—Will you kindly let me know why the cadmium solution gives a black plate when plating small parts such as pocket book forms. When I rack one line of frames then plate, it does not affect the frames. When plating 3 to 4 racks then my trouble starts, the frames get a black color, I cut down my current and still get the same results.

A.—The analysis of the solution is:

Cadmium	8.4 ozs./gal.
Total cyanide	19.4 ozs./gal.
Free cyanide	4.8 ozs./gal.

The metal is higher than necessary and the free cyanide considerably too low.

Inasmuch as the condition you describe indicates the possibility of contamination with impurities, it is suggested you remove ½ of the solution and add water. This will cut down the impurities and also bring the metal content down. After the dilution, add 6 ozs./gal. of sodium cyanide. It would be advisable to check this procedure on a small scale before changing the whole tank as the impurities may have reached such a concentration that dilution will not help and the use of more chemicals would not be warranted.

If impurities are due to excess brightener, electrolyzing the solution and then filtering may aid in removing the excess. The use of impure cadmium anodes or cadmium salts will also cause the production of dark cadmium deposits.—G. B. H., Jr.

Cobalt-Chromium Deposit

Q.—I would like to plate a heavy deposit of a cobalt-chromium alloy. The proportions I would like to obtain are cobalt 75% chromium 25% and the plating to be done on copper.

Could you possibly send me a formula that would help me and also whether I can obtain the solution ready made.

A.—A patent was issued to Schulein, No. 2,063,760, on the use of a chrome and cobalt solution. No data is given on the amount of cobalt deposited.

If nickel is added to a chromium solution it will not be included in the deposit, so it is not certain whether cobalt will act similarly or not.—G. B. H., Jr.

Incandescent Electric Carbon Brazing

EXPERIENCE over a period of several years, both in the plant and in the field, with a great number of every kind of joint under actual service conditions, has proved the advantages of incandescent electric carbon brazing, members of the American Welding Society were told recently in a joint paper presented by *Walter Reed*, of General Electric, and *Leo Edelson*, of the *Handy & Harman Co.* The authors pointed out the fact that not only is the new method a noteworthy contribution to the art of brazing but that its application has been greatly facilitated by the development of new brazing alloys and fluxes. Because of the proved advantages of brazing alloys containing silver, these types of alloys were the only ones considered in this discussion of the incandescent carbon brazing procedure.

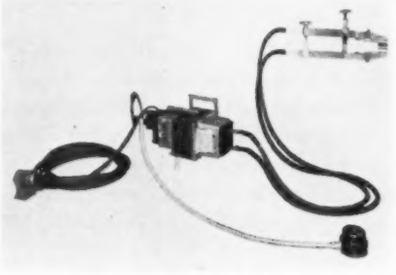
Essentially, the new method of brazing consists of assembling the joint, clamping it between the electrodes of a pair of brazing tongs, and passing electric current through the work. Advantages claimed for this type of joint are (1) takes less time and costs less than mechanical or soft solder joints, (2) lighter sections of metal can be joined, (3) joints do not require pretinning, (4) parts can be joined close to insulation or supporting members, (5) length of joint lap can be reduced, and (6) silver brazed joints, when properly made, stand up under thermal overload, vibration, corrosion, and mechanical and electrical stress. In addition, joints can readily be made in the field.

Generally speaking, alternating current is used for incandescent carbon brazing because of the ease of obtaining the necessary heavy current. The current is supplied to the brazing tongs directly from a transformer designed to furnish the current at the desired voltage. Ordinarily, the standard primary voltage is 220 volts. Secondary voltages range from 7.5 to 12 volts.

Brazing transformers are usually portable and are wound to take current from power lines and deliver it at lower voltage to the brazing tongs.

Electrodes

Three types of electrodes, soft, hard, and extra hard, are available. While all three of these electrodes are generally made from carbon and graphite, they vary considerably in their applications and advantages. The "soft" electrode has a low surface resistance, thereby practically eliminating the danger of overheating the work in spots, or "burning" the surface of the work through too rapid heating. It is of particular advantage when operators are new to



G. E. electric brazing equipment

the job. The "hard" type has a considerably greater surface resistance than the soft electrode and, therefore, operators should be given a certain amount of training before this electrode can be used. Its major advantage lies in the fact that brazing temperatures can be had with approximately 30 per cent less current. The "extra hard" electrode has the highest resistance thus far safely employed. Its surface resistance is correspondingly high and the danger from "burning" the joint surface is such that it should only be used by skilled operators. Its outstanding advantage is that it offers top brazing temperatures with only about 50 per cent of the current required by the soft type electrode. This means that comparatively large joints can be made with standard brazing equipment.

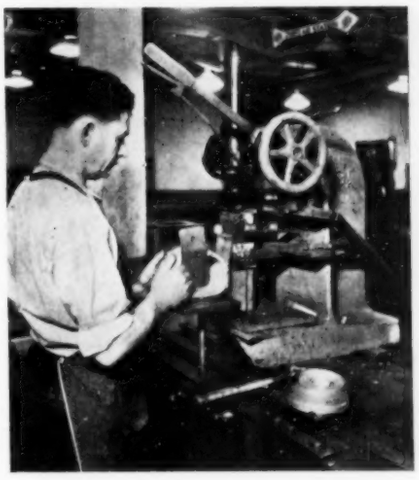
Diffusion Essential

Investigations have shown that the best silver-brazed joints are obtained when there is some degree of diffusion between the alloy and the metal. Diffusion is a time and temperature reaction and will vary with the type of metals joined. With a majority of non-ferrous alloys microscopic examinations show this diffusion. With steel and alloys that have melting points several hundred degrees above that of the brazing alloy, it is more difficult to positively determine this point, but the evidence obtained from the examination of a large number of specimens at high magnification would seem to justify the statement that some degree of diffusion is present in all properly made silver-brazed joints.

Lap, Butt, and Cable Joints

One of the basic reasons for the consistently good joints made by the incandescent carbon brazing method is that the joints are heated under pressure. In making lap joints, for example, the members are clamped between the electrodes under sufficient pressure to hold the parts securely together and make full even contact. The current is usually applied intermittently, so that the heat is evenly distributed throughout the electrodes, thus avoiding hot spots. Heating continues until the proper brazing temperature is reached; this temperature is indicated by the free flowing of the brazing alloy.

In making butt joints on materials up to one inch in width, the ends



Primary terminal being brazed on G. E. current transformer

to be joined together should be square to utilize the maximum contact areas. The ends should be butted tightly together and the electrodes applied to the thin sides of both members. Straight butt joints can be used on metal thicknesses of one-eighth-of-an-inch and under, but on heavier metals the members must be scarfed. The scarf should be approximately three times the thickness of the joint members.

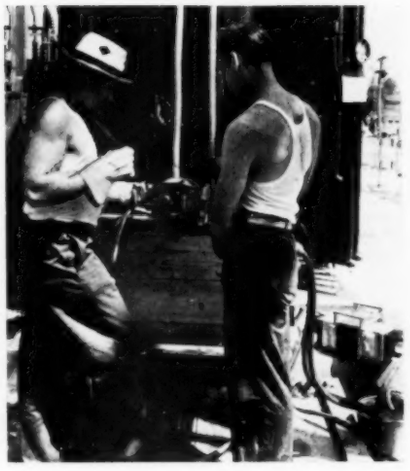
When cable is to be brazed, the strands should be wrapped so that they will retain their position. The cable should then be flattened and assembled between the electrodes. Heating is the same as in making lap joints but it should be remembered that, when joining cable, the brazing alloy must be applied at the cut end.

Stationary Brazing Equipment

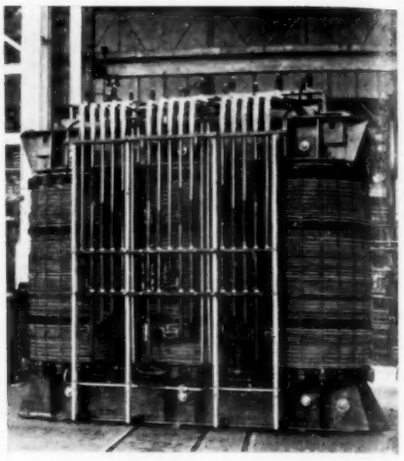
Where the work to be brazed is of such a nature that it can be brought to a definite point, it is generally advisable to use stationary equipment on which joints of practically any size can be made. The equipment usually consists of a press and apparatus to control the motion of the electrodes. Pressure is produced by means of an air cylinder or a mechanical lever. Larger-size transformers are usually used with this equipment and leads can be made heavy enough to carry the maximum current without heating and, if necessary, the electrodes can be water-cooled. Likewise, air cylinders and levers can be made to supply any required pressure. Presses of this kind, with capacities up to 100 kva., are in constant use. For press work, the soft-type electrode is most commonly used.

Corrosion of Silver Alloys

One of the questions most frequently asked in connection with the use of silver alloys is in regard to their corrosion resistance. It is difficult to make any specific statement, but their resistance compares favorably with that of copper, copper alloys, nickel silver, and nearly all of the non-ferrous metals and alloys which are used for their corrosion-resisting properties. Silver alloys are attacked by nitric acid, but so far as ordinary atmospheric corrosion is concerned, their resistance is similar to that of the different metals and alloys with which they are used. The problem of galvanic corrosion is probably the most important to be considered when joints made with silver alloys are subjected to various corrosive agents and, as laboratory tests are likely to be misleading, it is advisable to place specimens of brazed joints under actual conditions of use for sufficiently long periods of time to obtain reliable data.



Brazing terminals on lead covered cable in the field

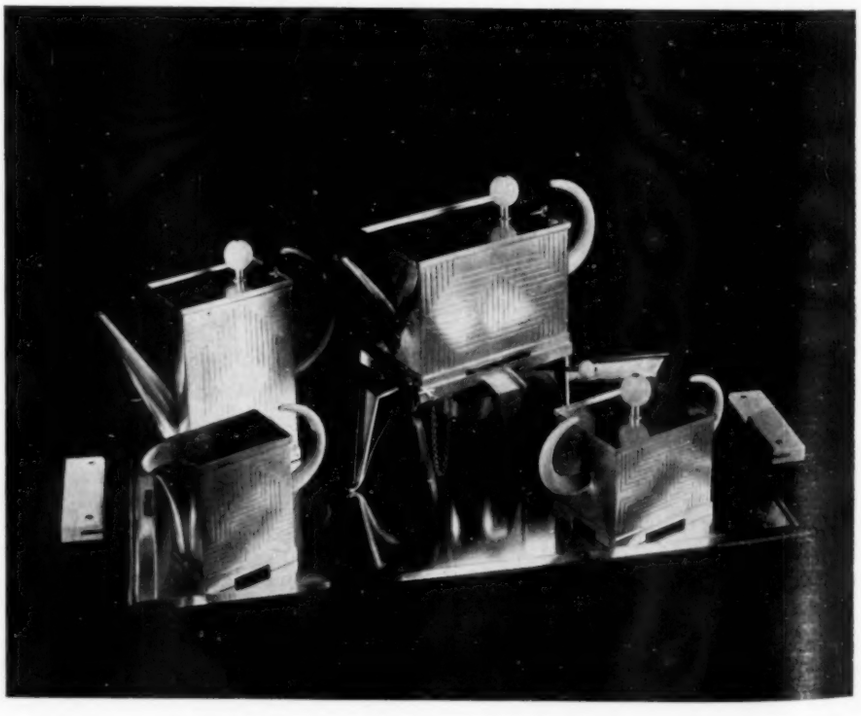


Assembled core and coils for transformer; 250 brazed joints

Modern Design in Silverware

Shown below is an illustration of a tea set of striking modern design. The large kettle is hinged to the stand and an alcohol burner keeps the water boiling. The pieces are rhodium plated. The design and details were worked out jointly by Anne Landsman, interior decorator of New York, and Peter Muller-Munk, assistant professor of Industrial Design, Carnegie Institute of Technology, Pittsburgh, Pa.

The set was executed by Professor Muller-Munk.



Sterling silver tea set. (Courtesy H. R. Isenburger)

British Institute of Metals Annual Meeting

Magnesium alloys, powdered (sintered) alloys, tin alloys, nickel brasses, hot tinning copper, and soft soldering discussed at the London Meeting.

THE Thirtieth Annual General Meeting of the Institute of Metals was held in London on March 8-10, 1938.

First Award of a New Distinction for Service to Metallurgical Science

Outstanding services to non-ferrous metallurgy were specially recognized by the Council of the British Insitute of Metals, which made the first award of the Institute of Metals Medal. This new distinction is to be bestowed, at intervals of a year or more, without restriction of nationality or membership of the Institute.

Sir William Bragg has been chosen as the first recipient of this new honor. President of the Royal Society and Director of the Royal Institution of Great Britain, Sir William is famous for his investigations in connection with the X-ray examination of metals, as well as in many other fields of scientific research.

The medal, which was offered to the Council of the Institute by the Mond Nickel Company, Limited, is of pure platinum, the metal of which it is composed having been prepared at that company's precious metals refinery at Acton, London.

Synopses of the papers presented follow.

"The Nickel - Copper - Magnesium Alloys," by *Professor W. R. D. Jones.*

Experiments have been carried out on the effect of adding copper and nickel to magnesium. The improved mechanical properties given to magnesium, when in the cast condition, by small additions up to about 2 per cent copper are enhanced by the addition of nickel, if the combined alloy content be 2¼-2½ per cent. A nickel content of 0.5-1 per cent (in the combined alloy content) has a greater effect than a corresponding copper content. These alloys are forged or rolled readily and, provided that care is taken to prevent cold-work, reasonably good ductility values are obtained. In the case of forged or rolled alloys, the beneficial effect of the addition of nickel as well as copper is not so pronounced; the effect of nickel depends to some extent on the proportion of copper present in the alloy. Billets which have been rolled after a preliminary drawing give better mechanical properties than those which have been drawn down to the same size.

"Alloys of Magnesium. Part VII.—The Mechanical Properties of Some Wrought Aluminium-Magnesium and Silver-Aluminium-Magnesium Alloys." by *John L. Haughton* and *A. E. L. Tate.*

The mechanical properties of pressed magnesium alloys containing up to 10 per cent of aluminium, with and without the addition of silver, were studied.

The effect of various amounts of reduction during forging was investigated, as well as the effect of the temperature at which the forging took place. It is shown that forging at 200°C., after a preliminary breaking down at 380°C., causes a marked increase in tensile strength, without appreciable loss of ductility, particularly in the case of alloys containing a small quantity of silver. The highest tensile strength was obtained with an alloy containing 8.5 per cent aluminium and 4.2 per cent silver, and the best elongation with an alloy containing 4 per cent, aluminium and 1.5 per cent silver, the ultimate stresses being 30 and 24 tons/in.^{2}, and the elongations 5 and 13.4 per cent, respectively.

Special attention may be directed to the alloy containing 6.5 per cent of aluminium and 1.5 per cent of silver, which has an ultimate stress of 27.3 tons/in.^{2}, a 0.1 per cent proof stress of 21.3 tons/in^2., and an elongation of 11.5 per cent.

"Sintered Alloys. Part I.—Copper-Nickel-Tungsten Alloys Sintered with a Liquid Phase Present," by *G. H. S. Price, C. J. Smithells, S. V. Williams.*

Factors which influence the preparation of alloys made by mixing, pressing, and sintering metal powders in an atmosphere of hydrogen have been investigated with particular reference to the copper-nickel-tungsten system. The distinctive character of the work is that sintering has been carried out at temperatures sufficiently high to ensure the presence of a liquid phase during the formation of the alloy.

The effect of time and temperature of sintering has been investigated with a copper 2, nickel 5, and tungsten 93

A medal of pure platinum, established as an award for outstanding services—either practical or scientific—to non-ferrous metallurgy, was presented for the first time at the thirtieth annual general meeting of The Institute of Metals. Sir William Bragg, noted crystallographer, was the recipient. The medal is two inches in diameter and weighs 4½ ounces. Harold Stabler was the sculptor.

per cent, alloy. Alloy formation, determed by density measurements and microexamination, does not progress uniformly as the sintering temperature is increased, but shows a rapid increase at a temperature of about 1300°C. Although considerable solid diffusion may occur at lower temperatures, it is essential that this temperature should be exceeded if alloys of "theoretical" density are to be obtained.

The time for which the alloys must be held at the sintering temperature to reach equilibrium is largely dependent on the composition. An alloy having a high percentage of the liquid phase reaches its "theoretical" density sooner than one in which the amount of liquid phase present is small.

A fundamental variable is the fineness of the metal powders, a longer time, or a higher temperature, being required for complete sintering when the tungsten grains are coarse. Fully-sintered alloys prepared in this way have no porosity, densities equal to the "theoretical" values.

"The Creep of Tin and Tin Alloys.—Part II," by *Professor D. Hanson*, and *E. J. Sandford.*

A description is given of results of creep tests on alloys of tin with 2 to 7 per cent cadmium and 3 to 9 per cent antimony. The influence of annealing at 170° and 200°C. is discussed. After cold-rolling and self-annealing, the best alloy is that containing 7 per cent cadmium and 9 per cent antimony; it withstands a stress of 1,200 to 1,400 lb./in.^{2} for many years. After annealing at 170°C., the most beneficial composition is 2 per cent cadmium and 7 per cent antimony; a safe stress for this alloy is 3,500 lb./in.^{2}. Annealing at 200°C. produces optimum creep properties at a composition of 3 per cent cadmium and 7 per cent antimony; a safe stress in this case is 3,700 lb./in.^{2}. It is shown that grain-size is an important factor in determining creep-resistance, and therefore, as the tensile strength is not greatly influenced by grain-size, no relationship is found between these two properties in the annealed alloys investigated. The effect of additions of 1 and 2 per cent silver, 1 per cent copper, or 0.3 per cent nickel is discussed. The silver and copper alloys show similar creep properties, but the nickel alloy is inferior. An alloy containing 1 per cent cadmium and 3-5 per cent silver has great creep-resistance when cold-rolled and self-annealed; it is superior to the alloy containing 7 per cent cadmium and 9 per cent antimony.

"The Physical and Mechanical Properties of Nickel-Brasses," by *Maurice Cook.*

After a preliminary study of the physical properties of alloys containing copper from 60 to 25, nickel 5 to 30, and zinc 30 to 55 per cent in the chill-cast condition and in the form of bar, hot-forged from chill-castings, a more detailed examination has been made of the properties of a few selected alloys in the form of extruded rod, with and without small additions of alloying elements. In addition to determinations of the physical properties of the extruded materials, observations have been made on the microstructure, machinability, and hot-stamping characteristics of the alloys.

"A Study of Some of the Factors Controlling the Porosity of Hot-Tinned Coatings on Copper," by *W. D. Jones.*

A distinction is drawn between the surface conditions of a tin bath (in which copper is being tinned) at the entry of the copper and at the exit. Molten salts and other materials maintained on the bath at entry are termed *fluxes* and control the wetting of the copper surface by the tin; and such materials at the exit from the bath are included in the term *cover*, and control the stability of the molten tin film on the copper surface after it has left the bath.

A major source of porosity in tin coatings on copper is due to a "running off" or "globularizing" of the molten tin film. This phenomenon is termed *dewetting* and is indicative of an instability in the molten tin film caused mainly by a high tin surface tension. Certain covers such as palm oil, stannic bromide, oxide films, etc., by reducing surface tension decrease the tendency to dewet. Other covers, such as ammonium chloride, or resin, permitting of a high surface tension, increase the tendency to dewet. Dewetting is favored by the presence of suitable nuclei, of which the most important are scratches and other discontinuities of the copper surface, imperfectly wetted areas, inclusions, and local variations in surface tension caused by temperature and concentration variations. The extent of dewetting is reduced by increasing the viscosity of the tin film (by presence of intermetallic compounds and by low temperatures) or by rapid solidification.

The experiments upon tin films on copper concerning dewetting have been duplicated, employing water films on a gold plate.

"The Influence of Surface Alloying on the Strength of Soft Soldered Joints," by *R. Chadwick.*

The joining of copper strip 0.005" thick by a series of alloys of lead and tin, including the pure metals themselves, has been studied. Joints were tested by pulling apart the two strips, adjacent ends of the strip being held in the jaws of the tensile machine. Except with pure lead joints, in which shear of the lead itself occurred, this test produced failure by stripping of the solder from the copper strip. This failure was shown to be due to the presence of a brittle copper-tin alloy film. Owing to the rapid growth of this alloy film, the time and temperature of joining had a profound effect upon joint strength.

A rapid method was developed of making joints under reproducible conditions, and joints so prepared were aged at temperatures from 100° to 500°C. For H.C. copper the joint strengths obtained by prolonged ageing did not fail below the characteristic strength of the weakest copper-tin alloy, in which failure occurred. Joints made with pure lead formed no alloy film, and consequently there was no appreciable loss in strength on ageing under any of the conditions investigated.

The fall in strength of joints due to the development of a brittle alloy surface film was slightly more rapid for the lead-tin alloys than for pure tin, probably due to the greater uniformity of the alloy layers produced.

The desirability of avoiding oxygen bearing arsenical copper in making soft solder products for use at elevated temperatures is pointed out. It is suggested however, that where possible, lead base alloys free from tin might be substituted for the conventional lead-tin solder, giving the advantage of stronger joints free from deterioration at all temperatures of ageing.

Society for Testing Materials Meetings

THE American Society for Testing Materials held its Annual Committee Week and 1938 Regional Meetings in Rochester, N. Y., March 7-11. About 675 registered for the meetings which were all well attended. A number of these meetings were of interest to metal products manufacturers.

Committee B-1 on Copper and Copper Alloy Wires for Electrical Conductors discussed proposed revisions for the standard specifications for bare stranded copper cable. Minor changes were recommended in resistivity requirements of Grades No. 9, 13 and 15 in the specifications for Hard Drawn Copper Alloy Wires for Electrical Conductors.

Committee B-3 on the Corrosion of Non-Ferrous Metals and Alloys concentrated most of its attention on the work of the Sub-Committee on Atmospheric Tests. The 1938 annual report will present the results of a third series of tests made on 24 non-ferrous metals and alloys exposed in 1931 to various atmospheres at nine test locations. The extent of corrosion is determined by (1) measuring the changes in weight of duplicate 9 by 12-inch plate specimens; (2) by visual examination of these plates; (3) by determining the changes in tensile strength and per cent elongation of tension test specimens. Various types of copper alloys, bronzes, aluminum and aluminum alloys, brasses, nickel and nickel alloys, lead, zinc and their alloys are included.

Committee B-5 on Copper and Copper Alloys, Cast and Wrought, approved for submission as a proposed new standard, specifications covering rolled non-ferrous bearing and expansion plates. New specimens for sheet and strip brasses will be recommended to replace the existing standard specifications for sheet high brass. Revisions will be submitted in the tentative specifications for bronze castings for turntables and movable bridges and tentative specifications are being proposed in the chemical composition requirements of the specifications for aluminum-bronze castings. The Committee recommended the adoption as standard of the specifications for bronze castings in the rough for locomotive wearing parts and for car and tender journal bearings, lined, and to withdraw the existing standards for sand castings of the alloy copper 80, tin 10, lead 10 and yellow brass castings for general purposes (B 65). The committee has under consideration new and changed specifications for manganese bronze ingots (B 7), sand castings (B 54) and standardized requirements for the nickel bearing copper alloys, up to 31% nickel.

Committee B-6 on Die Cast Metals and Alloys proposes to add a new alloy, No. XXV to the tentative specifications for zinc base alloy die castings (B 86-34 T). It differs in composition from the present alloy No. XXI in that its copper content is 1%. It has physical properties between present alloys XXI and XXIII.

Satisfactory progress is being made in the study of five tin-base and lead-base die casting alloys, in their physical properties. The corrosion and exposure test program, formulated last year, is now getting under way. Studies on magnesium base die casting alloys are yielding encouraging results.

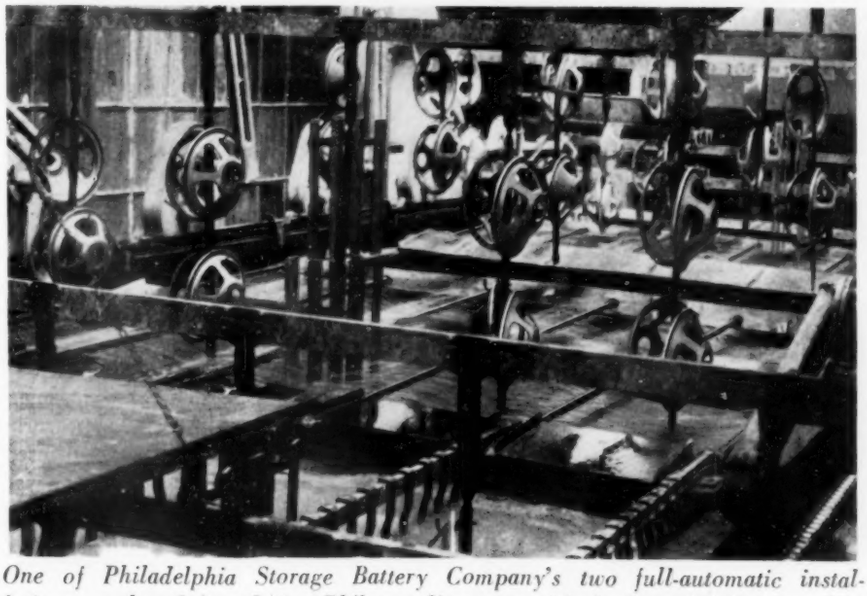
Committee B-7 on Light Metals and Alloys, Cast and Wrought, is considering some revisions in numerous specifications which will be referred to the Society for approval at the annual meeting in Atlantic City in June, covering magnesium as well as aluminum base alloys.

Work on the anodic oxidation of aluminum and its alloys has resulted in proposed new methods of testing anodized aluminum for dielectric strength which will be submitted to the Society for publication as tentative.

The *Research Committee on Fatigue of Metals* started a project studying the comparison of results of fatigue tests made on different types of testing machines in common use.

Full details of the work described above can be obtained from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Full Automatic Bright Zinc Installation



One of Philadelphia Storage Battery Company's two full-automatic installations employed for plating Philco radio parts with du Pont bright zinc. This installation turns out approximately 30,000 pieces of widely varied size and shape each 7-hour shift. In the foreground is the bright zinc plating tank with anodes, and just beyond, the last spray rinse before plating.

Fifty-Three Years as an Electroplater

Reminiscences of a retired pioneer, from the early days to the present.

By **D. W. ROBINSON**

Formerly Supervisor of Finishes, Remington Rand, Inc., Ilion, N. Y.

THE Editors of METAL INDUSTRY have asked me to relate some of my plating and other experiences during a period of fifty-three or more years. Having now retired from active service because of illness and age, I feel that I may accede to this request and hope that what I have to tell you may be of interest to METAL INDUSTRY readers.

First, I may state that all but the first fifteen years has been spent in the typewriter and accounting machine business as foreman or supervisor of plating and finishing, a total of thirty-eight years. I wish to tell first of how I came to engage in the work. As I look back over the years, especially the first fifteen years, I can see that I was bound to find out what there was to the plating business, no matter at what cost.

Fresh from the Farm

In 1882 I arrived in New Haven, Conn. with no experience except that common to a boy on a farm. My father raised tobacco and in those days that was hard work with not much return. If a boy got fifty cents or a dollar on occasion, that was something remarkable. My first work was for a contractor at $1.00 per day on a machine. I quit because the contractor did not keep his word. This was at the great *Sargent* plant. I cannot tell how long I was on this work. Within a day or so the evening paper had an ad for a young man as clerk in the shipping office of *Sargent & Co.* I made it my business to be on hand next morning very early. While walking up and down near the entrance to the office a man accosted me. He came out of the plant and said, "Good morning. You are out early," and asked me what I wanted. I told him about the ad and then he said, "Come upstairs," preceding me. When we arrived he asked me to do some sums and write so that he might see whether I could write well. He then told me to report to the head of that office and that I was hired. The man was none other than *J. B. Sargent*, the big man, and head of that great works.

No Interest in Clerking

It did not take me long to discover that this work was not what I wanted and after a short time I quit and got

D. W. ROBINSON

another job with the N. Y., N. H. and H. Railroad as receiving clerk at Derby Division freight station. I did not like this either. While thus engaged I was walking along a street and noticed an open door in a small building. Looking in, I saw men working doing something which aroused my curiosity. I walked in and was looking about, but was soon told to get out. I saw quite a bit and what I saw whetted my desire to find out more about what was being done there. At the back of a long room I saw tanks and steaming vats, while along one side were what I afterward learned were buffing lathes, mounted on a bench and men working at buffing buckles. I immediately asked for a job but did not get it then. A few days later I discovered that the men who were operating this shop lived just across the street from where I lived, so I struck the boss for a job with them and got it. This was my introduction to the plating industry.

A Job in a Plating Shop

I was instructed in buffing, in cutting cloth buffs, and keeping the place cleaned up, but was warned to keep away from the plating tanks. I really did make a beginning here but the mystery of how that nickel got on that brass I did not find out then. I did make out to do an acceptable job of buffing. It may be of interest to some to learn how I made the cotton buffs. Whole bolts of cloth were laid on a wide bench and partly unfolded to present a suitable number of layers. For different diameters of buff, steel flanges with a hole of suitable size in the center was laid upon the cloth and a very sharp hollow steel punch of right size was driven through the flange hole and cloth into the plank or bench top. Then with a very sharp knife I cut around the flange and through the cloth, pulled out the punch and had a nice section of buff ready to use. Well, I did not work there long as work got slack. I then secured work at *Peck Bros.* as a buffer on bath fixtures, getting quite expert, and worked there until I was laid off again because of slack work.

I soon got work with the *Elm City Mfg. Co.*, a firm making sewing machine attachments and doing job plating, polishing, buffing, burnishing, etc. Our biggest job was nickel plat-

ing, for nickel was becoming very popular, and as the *U. S. Licensing Nickel Co.* was apparently losing out, more firms were doing it. *Jas. Griffin* was the plater and I was sort of straw boss, clerk, timekeeper, giving out work to be polished, plated and buffed. Here I began to get a little insight into plating, being shoved into it, so to speak, thus becoming better posted. After some time *Mr. Griffin* had an offer to go to *Sargent* to take charge of some of the plating there, which he accepted, he and his brother Michael having charge of plating there for a number of years.

Early Dynamos and Solutions

At *Elm City Mfg. Co.* I had one of the first American made dynamos for plating, made by *Weston*. This machine had water running through the field magnets, a gadget to prevent reversal of current, two sets of sheet copper commutator brushes, etc. This machine would make current, but would reverse sometimes and the work would be plating off instead of on. It was very hard to keep it going. In spite of this and other handicaps we turned out some nice work, especially on bicycles, which were highly polished and buffed.

For plating I had Potts solution, also the *Gore* solution, both of these being discarded for regular double salts solution. In any of these it was slow work getting a heavy coating on, requiring patience and hours of time. I used potash, whale oil soap and kerosene to clean work, plus scrubbing; Tripoli, Crocus, silver and gold rouge for buffing. We had no white lime composition at that period. Polishing then was done about the same as at the present time.

New Haven being the center of fine carriage making, we were called upon to do quite a bit of silver plating for that trade; also some gold plating, for some of the carriages were beautiful and were sold to wealthy notables in Mexico, Spain and other countries. The wheel hub caps, handles, screws, bolt heads, etc. were plated. We also plated harness trimmings, mostly silver plate. Our main steady job was the sewing machine attachments. I think that *Greist Mfg. Co.* at Westville (New Haven) still make sewing machine attachments.

Promoted to Shop Foreman

After my boss, *Mr. Griffin* left, I was the boss temporarily, trying to carry on until the new foreman plater should appear. I saw some men come in with *Mr. Swift*, the manager, and look about, but apparently none of them wanted the job. After several days *Mr. S.* came to me and said, "Rob, you can run this job and I want you to take it." I told him I did not know enough. He said, "We will help you in every way possible and will take you to New York, Meriden and other places so that you may see what others are doing; also there are text books you can study which deal with the principles of electroplating, chemistry, electricity and their application, etc." *Mr. S.* was true to his promise and with him I visited a number of large and small plants in New York and Meriden. I do not know whether his idea was that a person could become a plater by observation, sort of absorbing it, as it were. Making many mistakes no doubt, I held this position nearly five years, when my health gave out and I was obliged to lay off and rest and relax, as too much work and worry had gotten the best of me.

Rest and a Change

Mr. S., the manager, had a friend who had a contract job at *C. Cowles & Co.* plant making carriage and coach lamps. He said he would get me an easy job with his friend as soon as I was able to work, and I could come back when I was ready. After a time of resting I went into the *C. Cowles & Co.* plant and was there about two years and learned how to do quite a number of things. There seemed to be quite a demand for these lamps as every sort of vehicle had them.

These Reminiscences will be continued in an early issue.—Ed.

Black on Brass

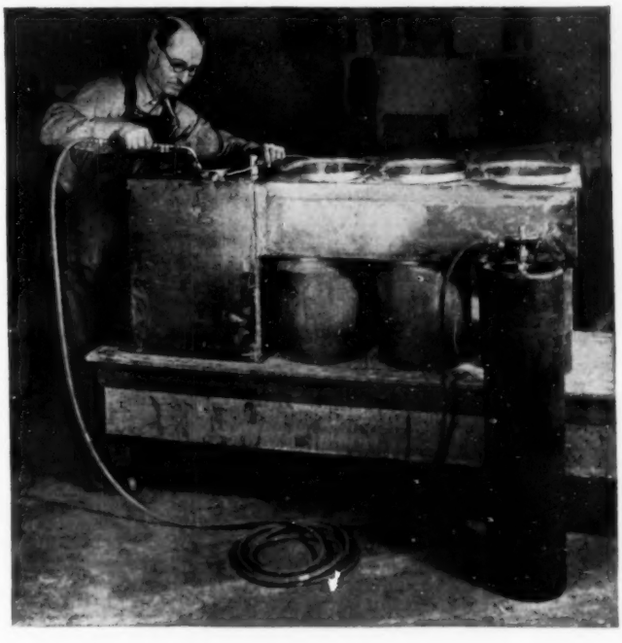
Q.—Enclosed you will find one brass fourball handle coated with a certain black composition unknown to me. I am trying to discover the method by which this coating is obtained.

A.—This finish can be obtained by copperplating and then giving a sulphide dip in either liver of sulphur or liquid sulphur.

Formulas for the cyanide copper and the sulphide solution can be found in the Platers' Guidebook, published by the METAL INDUSTRY.

—G. B. H., Jr.

Soldering Large Copper Units



The intensely hot iron speeds the soldering of this copper soda fountain unit. (Courtesy Linde Air Products Co.)

Metal Pictures by Electroplating

Artistic reproductions offer a new specialty for the electroplater.

By **CHARLES P. TREPPE**

ESSENTIALLY a new use for electroplating, metal picturization is a process of reproducing line and/or half-tone pictures, portraits, scenes, and the like composed solely of metal. It is distinctly different from the usual method of metal illustration, that is, of applying pigment to the surface by painting or metal lithography in that the contrasting colorant is incorporated into and is part of the surface of the supporting plate itself. However, since the sharpness of the final representation ultimately depends on the extent of difference in contrast of original materials and since metals are not possessed of much variety of colors, it is more or less limited to black and white reproduction.

Procedure Begins with Photoengraving

The art of photoengraving is utilized as a step in the procedure. By electroplating the engraved plate so produced the complete metal picture is secured.

The metal picture is composed of two metal divisions:

1—Metal Base—the major portion of the picture. It is the supporting base or background as well as a contributing color of the final picture.

2—Metal Contrast—is the applied contrastingly colored metal electroplate necessary to bring out the representation.

Metal pictures can be of two types depending on the color of the base or background; that is, a white contrast on black background or black contrast on white background. The former type of reproduction is unsuitable for general artistic work, except where the black color predominates as in dusk, dark, indistinct, fog, and weird motives. The black contrast on white base is the customary form for most representations.

White on Black Pictures

The procedure of obtaining white-on-black type of metal picture by electroplating methods is as follows:

A suitable black or dark metal plate is selected. Now since metals ordinarily do not possess good dark color qualities, we must compromise on copper or some of the darker bronzes; unless, of course, if we use a black chrome plated metal sheet.

The line and/or half-tone drawing, picture, photograph, illustration, portrait, or the like, all called copy, is first photographed through a screen not exceeding 100 lines to the inch. The selected plate is coated with light-sensitive film (cold top or fish glue resist) and exposed under the said screened negative in a manner that the transfer will result in a representation on the metal plate identical in position to the original copy, i.e., it is placed under a reversed negative. After suitable light exposure the metal base plate is washed and the unaffected portion of the film is removed. The exposed metal areas are then etched deeply chemically or electrochemically. An electro-etch or "de-plate" in chromic acid is recommended as it does not affect the resist. After an adequate etch, the metal base plate is removed and superficially cleaned, taking care not to harm the resist, and finally rinsed in an alkaline solution if the metal base easily forms protective oxides. The electroplater from past experience with the metal can decide what treatment is required to prepare the metal for good electroplating; ever mindful, of course, that polishing or immersion in concentrated chemical solutions will ordinarily affect the protective resist.

The metal base plate is immediately immersed in a white chrome plating bath and electroplated until the engraved metal areas are filled to any level with respect to the surface. If below the surface of the base plate, the picture is a bas-relief; if to level surface then it is a plane surface type, and if above the surface the reproduction is a high-relief type of reproduction. Cadmium, nickel-cobalt, silver, etc. electroplate can be substituted for the chrome plate if desired.

After sufficient plating, the metal base plate is removed from the bath and the resist is dissolved by rubbing the heated plate with sodium cyanide or placing it in hot alkali solution. The surface of the metal picture is then filed, etched, blasted or otherwise treated so that color impinges on the surfaces. This latter procedure intensifies the contrast between the base plate and electroplated metal so that the final reproduction possesses a better color.

Black on White Pictures

The procedure of obtaining a black-on-white type of metal picture and the only type which is satisfactory and can be recommended is as follows:

A suitable white metal plate is selected. A large variety of white colored metals or electroplates exist. Some of the more popular are stainless steel, nickel-silver alloy, white brass, Monel metal, nickel-cobalt plate (whitest colored metal plate), silver plate, nickel plate, and silvery chrome plate. Stainless steel sheet is the most applicable in the case.

The line and/or half-tone copy is photographed through a screen not exceeding 100 lines per inch as before. A positive is secured from this by re-exposure. The selected plate is coated with light-sensitive film and exposed under the said screened positive in a manner that the transfer will result in a representation on the metal plate identical in position to the orig-

inal copy. After suitable light exposure the sheet is washed and the unaffected portion of the film is removed. The exposed metal areas are then deeply etched by deplating in a concentrated chromic acid bath for approximately ½ hour at 20 amperes. After an adequate etch, the metal base plate is rinsed in a 10% alkaline rinse and after washing with water, immediately placed in a *black* chrome plating bath ready to electroplate. The alkaline rinse is necessary to dissolve the protective film characteristic of stainless and placing in the bath with the electrical connections on will plate a small film of black chrome which will prevent oxidation of the surface by the chromic acid in the bath.

Black Chrome Plate

The following are the bath formulas for *black* chrome plating:

1—A black chrome deposit is obtained by using 8-9 times the normal current density, 80-100 amperes per dm^2 or more, at a temperature not over 15°C. The solution should contain 250-400 g/l. of chromic acid with the addition of acetic acid or some other organic acid instead of sulphuric; 11-14 volts are used and it is *absolutely* necessary to cool the solution to keep the temperature down; otherwise grey deposits result. It can be plated with or without a nickel undercoat. The Ni must be free from strains. Bright chromium coating followed by black chrome may be plated on an article so as to make it partly bright and partly black for use as a sign. Throwing power of black chrome is no better than that of bright chromium. Black chrome is very hard.

2. .52—. 83 lbs./qt. chromic acid, 0.8—1.2% of acetic acid. Bath operated at more than 67 amperes per square inch and kept below 15°C.

After plating for a suitable length of time the stainless metal base is then cleaned in a hot alkali solution and immersed in hot chromic acid to etch the surface for better color. Reproductions should be placed on etched stainless steel sheet or sheet that has been slightly de-plated in a chromic acid bath; otherwise the directional polish and light reflection will blur the picture.

The finished product is an unusually beautiful reproduction composed solely of metal. It is exceptionally suitable for outdoor or indoor decoration, where wear-resistance is of vital importance. Portraits, commemorative signs and plaques, in stainless steel metal frames, can be secured which are quite permanent and also very artistic. Quite a large variety of uses can be found for such metal pictures.

Black Chrome Contrasts on Stainless Steel

For the electroplater who has not the equipment or knowledge of photoengraving practice the following is a simplified procedure for making black chrome metal contrast on stainless steel metal base pictures from the prepared plates secured from a photoengraver. A screened positive (with any line insertions the copy calls for) is placed on the etched stainless steel sheet, with the resist intact and no etch of metal. The metal base is then deplated and after rinsing plated with black chrome. Upon cleaning the metal picture is complete.

Copper—from Buttons to Statues

Below—Examples of Brass buttons worn by trainmen on various railroads during the "Iron Horse" era, which is generally associated with the Civil War period. These are casts from the original dies. (Courtesy Copper & Brass Research Assn.)

Ewing Galloway

Above—Imposing equestrian statue in Bronze of General Lafayette who served with George Washington in the Revolutionary War. This statue is located at Mt. Vernon Place in Baltimore, Md. (Courtesy Copper & Brass Research Assn.)

Wastes in Metal Finishing Operations

A plea for careful close control—electrical, mechanical, chemical. A list of all the operations showing where wastes occur.

By **PHILIP J. LO PRESTI**
Chemist, Hickok Mfg. Co., Rochester, N. Y.

ONE of the definitions of waste is something lost. This loss in business is related to profits. In other words if the causes of these wastes are found and eliminated, additions can be made to the profit column. The purpose of this paper is to describe some of the common operations of electroplating in sequence and show where some of these wastes occur.

If one starts from the bottom and examines the article to be plated, savings can be made by outlining the correct procedure of plating. The most economic process would include control over every operation.

A. Preparation of metal.

1. Polishing, buffing and coloring.
   - (a) Correct design of work chucks.
   - (b) Best efficiency from set up wheels.
   - (c) Correct grain size of abrasive for polishing operation.
   - (d) Most suited buffing compound for metal to be buffed.
     - (1) Consideration being given to quality, economy and ease of removal.
   - (e) Use of automatic equipment where possible.
   - (f) Efficient exhaust system.
2. Pickling and bright dipping.
   - (a) Correct acid for material to be pickled.
   - (b) Analysis of pickling solution for acid and metallic content.
     - (1) By regular analysis the most efficient solution can be determined considering speed, temperature, and acid content.
     - (2) Use of inhibitors in pickling to eliminate excessive etching of metal and to save acid.
   - (c) Means of reducing drag-out to a minimum.
     - (1) Less drag-out can be had by correct racking and draining of work.
   - (d) Check up of mechanical equipment to reduce excessive handling.
   - (e) Efficient exhaust system and protection of health of operators.
3. Barrel tumbling and burnishing.
   - (a) Descaling before barrel cut down.
   - (b) Correct ratio of burnishing medium in regard to work.
   - (c) Most efficient burnishing material considering speed, economy, and uniformity of burnish.
     - (1) Burnishing soaps can be analyzed to determine fitness for job.
   - (d) Use of automatic machines that burnish, separate, and dry work.
4. Cleaning before plating.
   - (a) Solvent degreasing.
     - (1) Determination of correct inhibited solvent by analysis of material and work accomplished.
     - (2) Solvent degreasing removes slushing and press room oils but alkaline cleaning is necessary before plating.
   - (b) Alkaline still and electric cleaners.
     - (1) Regular chemical analysis of cleaners.
     - (2) Determination of most efficient cleaner in regard to speed, economy and quality of cleaning.
   - (c) Acid and cyanide dips.
     - (1) Savings can be had by regular chemical analysis of dips.
     - (2) Life of dips can be lengthened by sufficient rinsing before entering dips.

B. Plating.

1. Regular analysis of all plating solutions.
   - (a) Analysis of composition of solution.
   - (b) Analysis of impurities in solution and estimating affect on solution operation.
   - (c) Use of sufficient clean rinsing water but seeing that all water taps are closed when not in use.
     - (1) Saving first rinse water for reclaiming.
     - (2) Reclaiming sludge after cleaning tanks.

(2) Electrical equipment maintenance.

- (a) Spare generator capacity for break downs.
- (b) Cleaning generators and replacing brushes at regular intervals.
  - (1) If possible installation of motors and generators in separate enclosed air conditioned and fireproof room.
- (c) Correct bus bar size.
  - (1) To reduce voltage drop.
- (d) Clean anode and cathode contact in plating tank.

(1) Anode rods can be covered with fire hose.

(3) Mechanical equipment.

(a) Use of the correct lining for tanks.

(b) Insulation of anode and steam connections from steel or lead lined tanks.

(c) Use of semi-automatic or full automatic plating machines where possible.

(d) Use of endless chain overhead conveyor to carry racked material to and from plating tanks.

(e) Use of insulated plating racks of correct design.

(1) This saves metal, racks, and increases throwing power on article plated.

(2) Correct arrangement of work on rack to insure even distribution of plate, and reduce drag-out of solution.

(f) Scrap anode saving.

(1) Insulated holder of scrap anodes. This holder gives full value on scrap in place of half value.

C. Lacquering.

(1) Testing of lacquers for fitness in regard to use of finished article.

(a) This includes coverage, hardness, flexibility, perspiration, and sulphur resistance, and whatever tests that relate to the future use of the finished article.

(2) Controlled atmosphere lacquer room.

(a) This to include control over humidity, flow of air, temperature and filtration.

(3 Correct mechanical equipment.

(a) Most efficient spray guns.

(b) Use of automatic equipment if possible.

This paper does not mention every possible source of wastes in electroplating but shows mainly that a good way to eliminate wastes is to have a clean, orderly, well lighted, and ventilated plating room; also to have the best equipment possible, and to have electrical, mechanical and chemical control.

Below are two examples of typical wastes.

Example No. 1—Electrical Equipment Maintenance

1. *Condition*

(a) Electrical generators of 15,000 amperes at 12 volts located in plating room. Generators unprotected and examined only when trouble occurred which included frequent burning out of brushes.

2. *Remedy*

(a) Installation of generators in clean ventilated and fireproof room. Weekly maintenance of generators by electrician which includes general cleaning, turning commutators, and adjusting brushholders so that brushes exert even pressure.

Example No. 2—Cleaning before Plating

1. *Condition*

(a) Incorrect cleaning process on steel articles coated with slushing oil, cleaned as follows:—

(1) Wiped off on buffing wheel with Vienna lime

(2) Home made electric cleaner of tri-sodium phosphate

(3) Water rinse

(4) Cyanide copper flash

(5) Water rinse

(6) Nickel plate

Result of this process was about 10% rejects due to excessive peeling and pitting.

2. *Remedy*

(1) Remove slushing oil in degreasing unit

(2) Correct electric cleaning

(a) Cleaner must wet surface and rinse freely

(3) Water rinse

(a) Used only after electric cleaner

(4) Acid dip

(5) Water rinse

(6) Nickel plate

Labor Turnover

Condition:—

1. Four acid copper tanks in operation.
2. No analysis of solutions.
3. No exhaust system on tanks.
4. Leaky rubber boots and gloves on operators.
5. Bad working conditions—including wet floor and no heating in room.

Result:—

1. Workers noses painfully running and numerous sores on arms and feet.
2. Work done very carelessly resulting in rejections that could have been avoided.
3. Workers quit job frequently, necessitating continual training of new help.
4. Cost of production much higher than necessary.

Remedy:—

1. General cleaning of whole plating room.
2. Installation of exhaust system on tanks.
3. Regular analysis and additions to solutions.
4. Proper maintenance of rubber gloves and boots.
5. Prompt first aid for cuts and sores.
6. Use of respirators when necessary.
7. Installation of duckboards on floor and efficient draining facilities.
8. Regular heating and exhaust system in plating room.

Conclusion:—

1. A good way to reduce cost in a plating room is to have maintenance of workers as well as the equipment.
2. The plating room should be clean, well ventilated and lighted, instead of a dirty hole in the basement.
3. It should be a place where one would be glad to work and not happy to leave.
4. Henry Ford has stated that, "I haven't seen a business fail yet that didn't accumulate a lot of dirt".

Bronze Finish

Q.—We are enclosing sample of bronze finish for your attention. Kindly advise us the name of this finish, if any, and complete operation sequence together with the plating and/or immersion formula.

A.—The finish can be obtained by immersion in a solution of barium sulphide. The strength of this solution can be from ¼ oz. per gallon and stronger to suit the metal.

The color can be set by immersing after coloring and rinsing in a solution of caustic soda.

Then scratch brush wet.

—G. B. H., Jr.

Shop Problems CASTING • METALLURGICAL FABRICATION • ASSEMBLING • • PLATING • FINISHING

Questions from readers relating to shop practice and answers by our associate editors

Blue on Cobalt Steel

Q.—Can you tell us how we can get a good blue, on steel having from 15 to 20% cobalt when in the hardened condition? Any of the methods or materials we have tried leaves it streaked or spotted, and even at the best it is a very pale blue.

A.—It is relatively more difficult to blue alloy steels than it is the ordinary high or low carbon steels. They do not as a rule take the deep blue that is obtainable on the straight carbon steels.

In order to obtain the best results the surface of the steel such as mentioned, should be absolutely clean and free from any oxide coating. Sand-blasting will produce a surface that will take a good heat blue.

If this surface is objectionable, polishing must be resorted to in order to obtain a clean surface. In some cases in order to prepare the steel surface for bluing after it has been sand-blasted or polished, the steel article is heated in a cyanide bath for a short period and then quenched in oil or water depending upon the steel. This is done in order to enrich the surface in carbon so that it will blue more easily.

This operation is only possible where such heat treatment does not effect the properties of the steel.

—T. H. C., Problem 5,647.

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Grease for Valves

Q.—Will you please advise us a form of valve grease, such as is used in water valves and water cocks. This is a thick, black, sticky greasy substance suitable to apply after the valves have been ground. If you can give us any help to obtain the proper material for this purpose, we would appreciate it very much.

A.—One of the graphite greases would be excellent for the service that you mention. It should be applied very lightly to the plugs. Use a soft dauber having a handle or backing so that the workman will not carry it on his hands. The graphite greases can be secured from various dealers and makers. Some users secure the flake graphite and add it to the grease or heavy oil. The petroleum greases having a texture like vaseline are suitable. Those that do not have an acid reaction should be used.

—W. B. F., Problem 5,648.

Peeling Nickel

Q.—We have made up a 400 gallon tank of nickel plating solution. We find that this nickel does not adhere very well to copper plate and readily peels if part is slightly bent.

We are sending under separate cover a sample of this solution and would appreciate your testing and commenting on its unsuccessful results.

We lowered the pH purposely to try and save this tank of solution but still were not successful.

Use this Blank for Solution Analysis Information

Fill in all items if possible.

Date .....

Name ..... Class of work being plated: .....
Address ..... City ..... State ..... Volume used: .....
Employed by: ..... Solution depth: .....
Kind of solution: ..... Cathode surface, sq. ft.: .....
Tank length: ..... width: ..... Kind of anodes: .....
Anode surface, sq. ft.: ..... Distance from cathode ..... Original formula of solution: .....
REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible.

Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 11[illegible] John Street, New York City.

A.—The analysis of the nickel solution is:

Nickel	2.67 ozs./gal.
Chloride (ammonium)	2.70 ozs./gal.
pH	5.2

The nickel and chloride can be brought up to 3 ozs. per gallon each. The pH is low although you state this was done in an attempt to remedy peeling.

From an examination of the peeled samples it appears that the difficulty lies in the condition of the copper plate surface before going into the nickel. Considerable care must be used in rinsing after a cyanide copper and before going into a nickel as any traces of cyanide which are left will cause a precipitation of nickel compounds on the surface of the metal and poor adherence will result. After cyanide copper, rinse well in running water, using preferably two successive rinses. Then in order to neutralize last traces of cyanide either a dilute acid dip can be used (5% muriatic or sulphuric) or better still dip the work into a crock of nickel solution which is slightly acid (pH 5.2) and transfer directly from this to the nickel tank.

Other factors that will have a bearing on the problem are the use of too much hypo in the copper solution, or the operation of the nickel at too low a temperature. For adherent ductile nickel, a solution of 3 ozs. of metal should be operated at about 70 deg. F.

As regards pH you should find better results at 5.8 than at 5.2. If above suggestions do not remedy peeling kindly advise further, giving all details possible, including sample of cyanide copper, and also cleaning and rinsing procedure and an effort will be made to locate source of trouble.

—G. B. H., Jr., Problem 5,649.

Peeling Oxidized Finish

Q.—We are sending you herewith an oxidized jiggered bronze plate, on which you will note the finish is flaking off. The plate was treated in the following manner:—

Polished, cleaned in electric alkaline cleaner, copper plated in acid copper bath. Copper is then buffed. Cleaned in electric alkaline cleaner; brushed with pumice stone; then oxidize jiggered. Washed with lacquer cleaner, then lacquered with spray.

Some plates treated in this manner are all right, while others develop the condition indicated by the sample, which has been in use about four years. Can you tell us what caused the trouble, and have you any suggestions to offer to overcome it?

A.—Peeling of an oxidized finish can be caused by using too strong or too hot a sulphide solution. A strength of about ½ oz. per gallon of oxidizing liquid is considered good for most purposes.

Another cause of peeling oxidized coating is too thin a deposit of copper. In this case the whole of the deposited metal is converted to the sulphide with the result that the only bond is between sulphide film and basis metal with consequent tendency to peeling. A heavier deposit is desirable in such cases.

A cyanide copper solution, run warm, would give better results as far as adherence of the deposit to the bronze affects the peeling. This would be more desirable also from the standpoint of doing the plating in an alkaline solution after an alkaline cleaning treatment. To prevent spotting out of the finish in this case the use of lacquers designed to prevent this trouble is suggested.

In some cases it is advisable to first give the work a light sulphide dip, then rinse and remove this coating in a cyanide solution. Rinse and then sulphide dip for the final oxidize. In this way any films left on the work will be removed by the preliminary sulphide treatment.

—G. B. H., Jr., Problem 5,650.

Plating on Aluminum

Q.—I want a formula for cleaning and plating copper and nickel finishes on aluminum. Is this being done successfully? I have plated some in the past and find that after a short time the plate rises and blisters from the base metal.

A.—There is no completely satisfactory method for plating on aluminum at present. The Aluminum Co. of America recommends a short immersion in a solution containing 1/3 oz./gal. each of soda ash and trisodium phosphate at 180-200 deg. F. This is followed by a short dip in a 5% hydrofluoric acid solution. The work is followed through a nickel dip, manganese dip or nitric-hydrofluoric acid dip, depending on the alloy and finally plated. The nickel solution recommended contains:

Single nickel salts	19 ozs./gal.
Magnesium sulfate	10 ozs./gal.
Ammonium chloride	2 ozs./gal.
Boric acid	2 ozs./gal.

90-95 deg. F., 15 amps./sq. ft., pH 5.8-6.0.

Copper may be applied over the nickel coating.

Another procedure is to plate first in a special zinc solution. Details may be found in the booklet published by the Aluminum Co. of America called "Finishes for Aluminum."

—G. B. H., Jr., Problem 5,651.

Soldering Antimonial Lead

Q.—We are attempting to solder antimonial lead castings and are having considerable difficulty in getting clear, free joints with the material we are using.

These antimonial lead castings are approximately 87% lead and 13% antimony and naturally melt at a very low temperature, necessitating a solder which should melt at a very low temperature and flow very freely with the use of a blow-torch.

We might add that we are using rosin flux which may have something to do with our particular problem.

A.—The antimonial lead that you are using is the eutectic composition which means that it has the lowest melting point of any alloy of lead and antimony. Its melting point is approximately 473 deg. F. The purpose of the antimony is to harden the lead.

A rosin flux is recommended for this alloy but some of the fluxes in the paste or liquid form might be tried to advantage. These are much easier to apply and are more effective. See the advertisements in METAL INDUSTRY.

As to the solder to use, try the eutectic of lead and tin, which contains 69% lead and 31% tin, and melts at 356 deg. F. This is over 100 deg. lower than that of the castings. If a lower melting solder is needed, then add a little bismuth, such as 1% or so to the alloy.

—W. B. F., Problem 5,652.

Metal Casting Digest

Short abstracts of articles of interest to practical non-ferrous foundrymen and metallurgists

By H. M. ST. JOHN
Associate Editor

Nonmetallic Inclusions in Brass Chill Castings. L. Lencauchez. Met. const. me'can., Vol. 67, page 14 (1935); Chemical Abstracts, July 20, 1937, col. 4935.

Sources of nonmetallic inclusions are discussed.

• • •

Surface Treatment of Magnesium Alloys. H. Reininger. Metallwaren-Ind. Galvano-Tech., Vol. 35, pages 41, 63, 99 (1937); Chemical Abstracts, July 20, 1937, col. 4942.

Review of passivation and coloring of magnesium alloys by various methods. Protection by paints and lacquers is also discussed. Fifty-one references.

• • •

Refractory Materials. Part I. J. H. Partridge. Metal Industry (London). July 23, 1937, page 81.

A detailed discussion of recent developments in the production and properties of refractories, with methods of testing. In the past, highly refractory materials, when introduced to the trade, have sometimes failed to give the results expected of them, not because the refractories were unsuitable, but because the bonding material and texture were incorrect. Much has been done to overcome these difficulties.

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Same as Above. Part II. Metal Industry (London). July 30, 1937, page 111.

Discusses the technique employed in the manufacture of refractories from non-plastic materials. The ability to withstand extreme temperatures is dependent largely on the purity of the material, but often oxides containing impurities are mechanically stronger at high temperatures. It is difficult to state to what extent the sintering together of particles to form a hard, dense, compact body is due to the bonding action of the small proportions of impurities present, how much to the growth of the particles under the influence of the high temperature firing treatment.

• • •

Graphite in the Metal Industry. H. N. Bassett. Metal Industry (London), July 23, 1937, page 87.

Discusses various applications of graphite, including its use in clay-graphite crucibles.

• • •

The Solubility of Hydrogen in Metals. By "Recorder," Metal Industry (London), July 23, 1937, page 88.

A mathematical discussion. The accurate measurement of solubility of a gas in a metal is the most difficult experiment in metallurgical research. The author believes it unfair to refer to "the solubility of hydrogen" in a metal when a hydride having a different lattice type is present.

• • •

Degasification of Aluminum Alloys. G. Mann. Metal Industry (London), July 23, 1937, page 89.

Degasification of aluminum alloy melts with aluminum chloride resulted in an improvement in the physical properties and a reduction in pinholing. Further investigation into the use of aluminum chloride as a flux is justified.

• • •

Zinc-Base Die-Casting Alloys. Part I. H. C. Evans. Metal Industry (London), July 30, 1937, page 105.

A review, discussing the effect of composition on structure and properties.

• • •

Light-Metal Bearings. R. Hinzmann. Metallwirtschaft, Vol. 16, p. 477 (1937); Chemical Abstracts, Aug. 10th, 1937, col. 5306.

A review of magnesium and aluminum bearing alloys. These are suitable generally where the stresses are not great. In some cases aluminum-base bearings have performed well under considerable stress and unusually high temperature. The physical structure of a light-metal bearing is of more importance than its chemical composition.

• • •

Magnesium Alloys Containing Manganese. V. O. Gagen-Torn and Ya. A. Tsenter. Metallurg, Vol. 11, page 85 (1936); Chemical Abstracts, Aug. 10, 1937, col. 5306.

Mechanical properties of magnesium alloys containing 0.83-1.70% manganese can be improved by adding aluminum 0-4.22, zinc 0-2.82, and cadmium 0-0.54%. Corrosion resistance of these alloys can be increased by heat treatment.

• • •

The Effect of Manganese on the "Annealing Brittleness" of Cupro-Nickel. B. K. Bose. J. Inst. Metals, Vol. 60, advance copy No. 768 (1937); Chemical Abstracts, Aug. 10, 1937, col. 5306.

The elimination of brittleness in the copper-nickel alloy (75 copper, 25 nickel) when annealed at temperatures above 700°C, by the addition of manganese was investigated by measurement of its effect on the physical properties as determined by elongation, tensile strength and impact tests.

• • •

Physical Methods in Metallurgy. Part IV. X-Rays. Bruce Chalmers. Metal Ind. (London), Aug. 6th, 1937, page 135.

Nature of X-Rays; penetration; X-Ray diffraction; Laue method; powder method; rotating crystal method; applications.

• • •

Zinc-Base Die-Casting Alloys. H. L. Evans. Metal Ind. (London), Aug. 6th, 1937, page 139.

Ageing changes; intercrystalline corrosion; testing and applications.

• • •

Fluid Shrinkage in Bronze Castings. E. Longden. Metal Ind. (London), Aug. 13, 1937, page 155.

Correct gating for small heavy castings is shown, with provision for both adequate feeding and assurance of clean metal.

• • •

Feeding Aluminum Alloy Castings. R. Perret. Metal Ind. (London), Aug. 27, 1937, page 211.

The origin of blow holes and of the formation of films of oxidized metal in aluminum alloy castings is discussed. The author attributes these defects mainly to incorrect feeding of the moulds and outlines methods for their elimination, taking the moulding of Alpax castings as an example. He recommends the use of a pouring basin, having a stopper and made from an oil-sand core or refractory material such as graphite electrode ends. Oxide films are best avoided by pouring at a velocity low enough not to rupture the film normally surrounding the molten metal.

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Mechanical Properties of Four Binary Tin Bronzes at Room and Elevated Temperatures. Part I. Claus G. Goetzel. Metals & Alloys, Aug. 1937, page 231.

(1) 94 copper, 6 tin; (2) 90 copper, 10 tin; (3) 86 copper, 14 tin; (4) 80 copper, 20 tin. These are the German standards WBz 6, GBz 10, GBz 14 and GBz 20. Rods were cast and tested in the cast condition and after annealing. Casting and annealing methods are described and results summarized in tables and graphs. Tested at room temperature, GBz 14 showed the most notable effect from annealing and in the annealed condition had, on the whole, the best physical properties (45,000 psi tensile, 33% elongation, 67 Brinell). Above 300°C all four alloys lost strength rapidly.

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Same. Part II. Metals & Alloys, Sept. 1937, page 245.

Results illustrated by photomicrographs. The author believes that, with expert casting technique, maximum properties of these binary bronzes, not generally obtainable, can be obtained, and that their castings have great value.

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Copper-Lead Bearing Metals Favored for Severe Service. Francis G. Jenkins. Metal Progress, Aug. 1937, page 145.

Increased speeds and bearing loads have exceeded, in many instances, the best performance of which babbit is capable. Copper-lead bearings have the necessary properties and are less affected by temperature. The lead content ranges up to 35% or more. Nickel from 1.0 to 2.5% helps to keep the lead dispersed throughout the copper. Silver up to 1.5% may be added because it raises the recrystallization temperature of copper and thus retards loss of strength by annealing when elevated temperatures are encountered. Zinc is an undesirable impurity but pnosphorus may be used as a deoxidizer if the residual does not exceed 0.05%.

Modern Production Equipment

New processes, machinery and supplies for metal products manufacturing and metal finishing

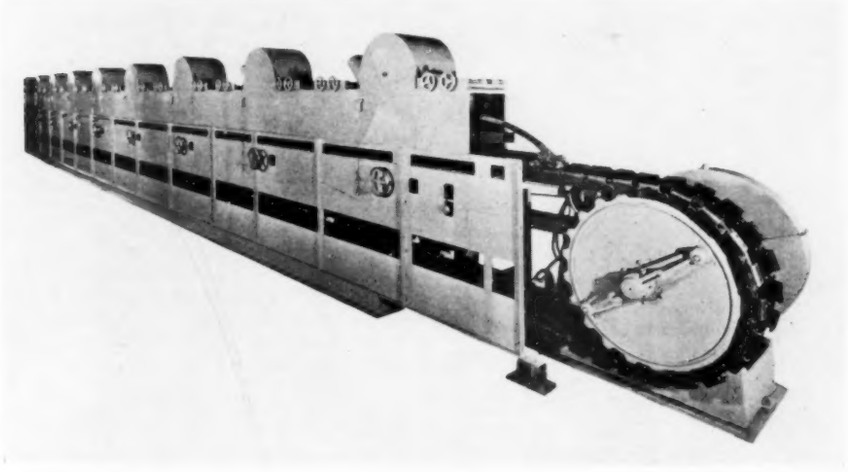
Straight Line Polishing Machine

Divine Brothers Company, Utica, N. Y., recently shipped three machines like the one shown in the accompanying photo. The machines are to be used to automatically polish automobile bumper bars. In size they are believed to be the largest polishing machines ever built, being over 100 feet in length; 9 feet high; and weighing over 40 tons apiece.

Advancements in designs include features which permit the polishing wheels to follow the bumper bars continuously, regardless of the height of the camber. Each polishing unit is separately adjustable and controlled, or the entire machine may be started or stopped through push button controls.

The machine is simple to operate in spite of its size, and produces continuously at peak loads. All adjustments are handy to the operators, and safety devices are used to prevent injury to the operator of the machine.

Divine Brothers Company reports having shipped 54 carloads of automatic polishing and buffing machinery during 1937, including some of the largest installations of their kind in the industry.



Divine straight line polishing machine

Bright Nickel

The Seymour Manufacturing Company of Seymour, Conn., prominent as the producer of nickel silver and nickel anodes has perfected a process whereby bright nickel plate can be secured from standard baths by means of certain addition agents. This process, it is stated, produces a brilliant plate of nickel which is soft and ductile, and requires a minimum of control, characterized by freedom from pitting and ease of operation. The following information is given by the manufacturers.

Seymour bright nickel may be deposited on steel, either directly or over copper plate, on brass or other non-ferrous alloys, and on zinc-base alloys which have been previously copper plated or dull nickel plated. No special preparation of the base metal is necessary other than a suitable high finish. Seymour bright nickel is not passive and can be chromium plated without activation or color-buffing, and the nickel does not tarnish readily.

The solution is stable, has good throwing power, and produces a bright plate at all thicknesses of deposit. No agitation is required, nor any circulation of solution, and the process is applicable to still tanks or automatic tanks.

Accurate control methods are available to keep correct the concentrations of ingredients in the bath. With efficient operation, and the use of special Seycast anodes, the nickel content and the pH require little adjusting. Seycast anodes have been developed with the bright nickel process and are designed for operation in solutions having a pH lower than 4.5. These anodes are said to corrode smoothly, form no heavy sludge or any loose particles of nickel. The anode is cast and costs no more than any 99% plus cast nickel anode.

The brightening ingredients for Seymour bright nickel are furnished as three solutions to be added to a Watts bath containing 37 ounces per gallon nickel sulfate, 8 ounces per gallon nickel chloride and 5 ounces per gallon boric acid. Replenishment is made as needed by three solutions: No. 1 which is the brightener; No. 2 which is the anti-pit; No. 3 which is a maintenance solution. A simple volumetric method indicates the concentration of the brightener in the bath. A surface tension

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Power Squaring Shears. Series KL—6, 8, 10½ and 12 foot lengths for flat shearing of ⅜″ steel and 14 and 16 foot lengths for ¼″ steel. Niagara Machine and Tool Works, 637 Northland Ave., Buffalo, N. Y.

Roll Platform Truck. Clark E-Z. Wide range of standard sizes and also special sizes to meet individual requirements; low price. All Steel Welded Truck Corp., Rockford, Ill.

Manual By-Pass; now standard equipment on Taylor Fulscope micromax controllers; changed over from manual to automatic control or vice versa. Taylor Instrument Companies, Rochester, N. Y.

Portable Hacksaw Machine; to speed up metal cutting. Automatic determination of the exact pressure required to cut any degree of hardness in metals; holds the saw at any position without danger of its falling. Master Machine Co., 872 W. North Ave., Chicago, Ill.

Two-Point Suspension Single or Double Action Press; novel design; quiet operation. E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio.

Super Welding Hose; designed to guard against accidental explosions caused when both gas lines are subjected to sparks and hot metals in welding operations. York Belting & Packing Co., Passaic, N. J.

measurement by a stalagmometer indicates the need of the anti-pit, and the maintenance solution is added only to replace the ingredients lost by drag-out.

The Seymour bright nickel bath is operated under the following conditions: temperature 110°-120° F.; current density up to 40 amperes per square foot; pH 2.0 to 3.0 (electrometric); surface tension 32 to 37 dynes per cm. The tank must be rubber lined and Seycast Anodes are recommended. Anode bags are furnished. The solution must be filtered when necessary, but continous filtration is not required.

The Seymour bright nickel ingredients should be added only to a Watts solution, of the composition given, which has been made up new, purified and filtered. The use of ammonia or ammonia salts is not recommended and adjustments of pH should be made with sulfuric acid or nickel carbonate.

The manufacturers recommend the following procedure for the purification of a nickel solution to be used for Seymour bright nickel plating:

Add all plating ingredients to 70 or 80 gallons of water and heat to at least 150° F. Mix at least 5 pounds of lime in several gallons of hot water or nickel solution and stir into the tank. Stir solution for about one-half hour, cool a sample, filter and take the pH. If it is not above 6.0 quinhydrone add more lime. After about an hour, if temperature is above 150° F. add 32 ounces of 100 volume peroxide and stir. Allow to settle over night and filter. Heat to 110° F. and adjust pH to 2.8 quinhydrone. We recommend doing the purification in one tank and filtering the solution into the clean plating tank. These quantities are for 100 gallons of plating solution.

Dropping Test Set for Zinc Coatings

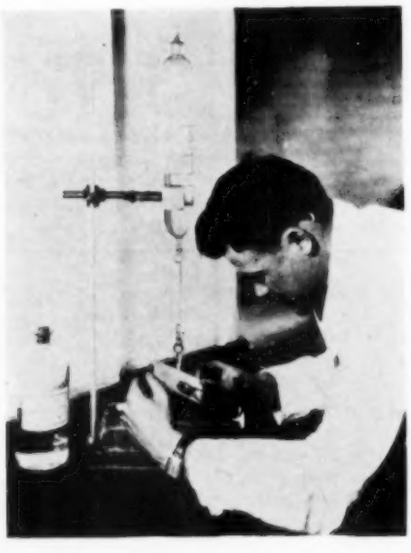
The zinc dropping test set made by the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies, is used for determining the thickness of electroplated zinc coatings by the Hull & Strausser method. This method is simple, requiring only a few minutes to make a determination, and the readings are sufficiently accurate for control purposes.

The reservoir is filled with the proper test solution and both stopcocks opened until all air is displaced in the delivery tube. Leaving the lower stopcock in the open position, the upper stopcock is adjusted so that approximately 100 drops per minute issue from the burette tip. With the upper stopcock remaining in this position the flow is stopped by the lower stopcock.

The specimen to be tested is cleaned by rubbing with a cloth moistened with trichlorethylene and placed two or three inches under the capillary tip at an angle of 45 degrees from horizontal. The lower stopcock is opened and the solution allowed to drip on the specimen. The period required from the time the first drop touches the plate until the bare steel is exposed is measured with a stopwatch or the second hand of a pocket watch. Each second elapsing during the test represents a thickness of deposit of .00001". For example, if the basis metal appears after 22 seconds of dropping of the solution, the thickness of the deposit will be .00022".

After the test is completed the lower stopcock is closed and the glass stopper placed in the burette. The solution in the glass tray is discarded, as it is suitable for making a single test only. If stripped work is to be replated, rinse quickly after the test and replate as usual.

The dropping rate must be checked after several tests. This method gives an accuracy of within 10% of the actual thickness of deposits.



Using the H-VW-M dropping test set for zinc coatings

Aluminum Paint

An aluminum paint called Sapolin No. 124 Hot Pipe Aluminum is one of the products of Sapolin Co. Inc., 229 E. 42nd St., New York. The paint gives a bright aluminum finish for metal surfaces that can be subjected to heat as high as 1200 deg. F. The manufacturers state that Sapolin bakes into and becomes part of the metal itself. It contains aluminum paste and a special heat-resisting vehicle (varnish type) ready to mix.

Trim Saw

The Van Dorn Electric Tool Co., Towson, Maryland, announce the No. 35 Electric Trim Saw as the latest addition to their line of portable electric tools. This saw is only 11¼ lbs. in weight, very compact in construction and is said to have excellent balance for ease in handling. It is especially recommended for trim work for the builder, light crating jobs for the shipper and general saw usage where 1⅜" is the maximum vertical cut required.

Punch-Press Control

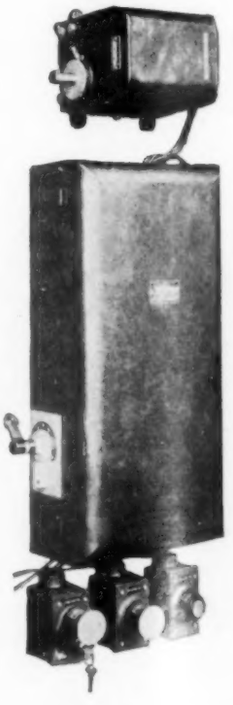
Developed primarily to minimize the possibility of false operation, a new control system for punch-presses actuated by air clutches has been designed by General Electric Co., Schenectady, N. Y. The new equipment, consisting of a magnetic control panel, a rotating cam-type limit switch, and oil-proof push button stations, permits four different operations, from "continuous stroke" to "inching," while the safety hazard of false operation arising from wiring failures caused by oil and severe vibration has been comparatively eliminated.

The magnetic control panel regulates a solenoid valve in the air-operated clutch system. A four-position selector switch, which can be locked in position, modifies the circuit so that any of the following operations may be obtained: "Continuous stroke"; "short," which allows one complete stroke of the press; "long," used with presses having a long stroke and which allows the operator to "inch" the press down to a certain point at which the solenoid remains energized and the press automatically completes the stroke; and "inching" or jogging.

All push buttons, limit switch contacts, and contactor coils are connected in the secondary circuit of a specially designed control transformer. This makes it impossible for a ground at any point in the system to energize the solenoid falsely.

The rotating cam-type limit switch is so designed that the contacts are opened by a positive cam action in order to minimize the possibility of the press continuing to run because of failure of these contacts to open at the prescribed time.

The control circuit employed reduces the number of external control wires to a minimum, thus decreasing the possibilities of wiring failures and reducing the installation and maintenance expense.



G. E. punch press control

Metal Office Equipment Finish

Sherwin-Williams Company, 292 Madison Ave., New York, has recently introduced a new specialty finish for office furniture and business machines etc. for which many unique features are claimed.

The finish is known as S-W Satin-Glo, and is offered in two spraying and two dipping qualities to meet the requirements of this trade. S-W Satin-Glo is said to produce a finish of pronounced beauty, lustre and mar-resistance in one coat. It is also resistant to severe abrasion, perspiration, chemicals and cleaning soaps.

Satin-Glo is built around a chemically evolved vehicle developed to produce the toughest finish when baked. The manufacturer reports that for 7 months test batches of Satin-Glo were left uncovered to determine their "tank" characteristics, and by simply adding thinner to compensate for evaporation, the finish showed no evidence of skinning, separating, flooding, settling or thickening at the edges.

Other tests conducted on Satin-Glo to prove the superiority of the new principle

The abrasion test for finishes

in a vehicle and fine grind of pigments were on opacity, sensitiveness to baking temperatures, adhesion after baking, uniformity of gloss, color stability, abrasion resistance, resistance to printing, economy in production, and ability to withstand numerous chemical reagents.

Test for Goggles

One of the most vivid demonstrations of the value of safety goggles, according to T. A. Walsh, Safety Engineer of the American Optical Company, Southbridge, Mass., is the one devised in the Gulf Oil Corporation, Port Arthur, Texas, plant, and used by their Safety Department to illustrate to employees the efficiency of safety goggles provided by the company.

The demonstration consists of lifting a three pound machinist's hammer attached to a fulcrum and operated by a chain, and letting it drop on safety goggle lenses placed on a block. The lens used for the demonstration has been under exposure to these blows for a period of three months without breaking, despite the severity of the punishment.

Constructed by B. W. Edgley, foreman in the Port Arthur plant, the demonstrator has been installed at the various gates of the refining plant, and workers going through the gates are privileged to pull the hammer as many times as they desire.

The test is designed to demonstrate that safety goggle lenses hardened by Super Armorplate processes can resist blows equivalent to any they may possibly receive in the course of daily duties.

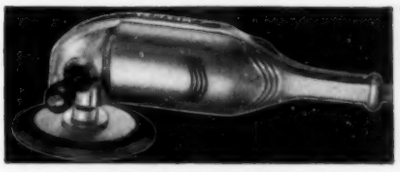
Hammer test for goggles

Special Duty Disc Sander

An addition to the line of Skilsaw Disc Sanders is announced by the manufacturers, Skilsaw, Inc., Chicago, Ill.

The new special duty Model "N" disc sander has been developed particularly to provide a lower priced, efficient tool for intermittent grinding of light welds,—for sanding in repair work,—for smoothing fractures in cast metal frames,—for auto body and fender repair work,—for removing stencils and labels from barrels and shipping cases.

Like the larger models, Model "N" Disc Sander has a balanced streamlined body design that makes it easy to handle and control under all conditions. It is powered for fast grinding and sanding and for use with wire wheel brushes in cleaning metal surfaces. Straight-line ventilation to assure a cool running tool and an efficient air filter to protect the commutator and motor from abrasive dust and dirt are provided. There are high-grade ball bearings on all shafts. Model "N" is 15¾ in. long and weighs 10½ lbs.



Skilsaw special duty disc sander

Hardness Tester

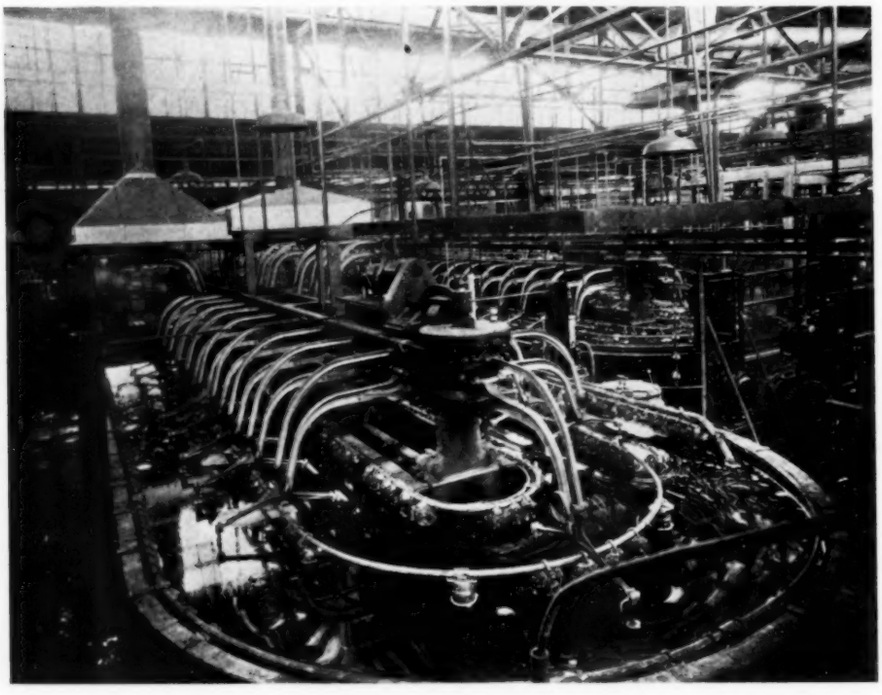
The portable Brinell meter illustrated herewith simultaneously makes impressions in a reference bar and the material to be tested. The outfit consists of an instrument within which to nest a standard reference bar. The standard reference bar is supported in contact with a standard 10 millimeter steel Brinell ball. The assembly is then placed in position on the surface of the material to be tested. A plunger within the instrument is given a sharp blow with a hammer. The Brinell ball produces a simultaneous impression in the bar and in the surface of the material under test. The impression diameters are then compared and by reference to a direct reading hardness table provided for the reference bar, the Brinell hardness of the material is quickly noted. By the same token the tensile strength of the material is quickly computed. The outfit is enclosed in a carrying case 6½" x 9½", and weighs 6¾ lbs. Made by Louis C. Eitzen Co., 280 Broadway, New York.

Eitzen portable Brinell meter

Tanks and Racks Have Successful Record in Bright Nickel Plating Service

This Triflex rubber-lined steel tank is one of two supplied the Knapp-Monarch Company of St. Louis, Mo., by The B. F. Goodrich Company, Akron, O. for Harshaw XXX bright nickel plating service.

All plating racks are coated with Korolac, a synthetic rubber-like material which was also developed by Goodrich. Since adopting this coating material, the user reports considerable savings by eliminating loss of the nickel which previously plated out on the racks. Rack replacements have been reduced to a minimum and a more uniform plating is obtained.



Triflex-lined steel tank of the Knapp-Monarch Co., St. Louis, Mo., for Harshaw bright nickel.

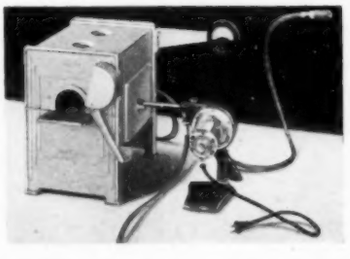
Both tanks have been in service for over a year, during which time they have required no repairs and have given extremely satisfactory results.

Hydrogen Brazing Furnace

The Stark Electroblast hydrogen brazing furnace was developed from the high speed muffle furnace made by the Stark Tool Co., Waltham, Mass. The hydrogen brazing furnace is made for bench mounting and requires space of 15" x 20". It consists of a heavy sheet steel case with cast iron ends and door; lined with high grade insulating refractory and furnished with a silicon carbide muffle which excludes combustion gases and oxygen. Refractory and muffle are easily removable.

Heat is generated by a self-contained burner powered by a 1/15 h.p. General Electric ball bearing universal motor for the air blast. Burner and torch are separate from the furnace and can be used alone for other operations requiring heat.

The hydrogen atmosphere is provided by tank hydrogen. The furnace is provided with pressure regulators, gauges, connections, etc.



Stark Electroblast hydrogen brazing furnace

complete. A pyrometer with a range up to 2400 deg. is part of the regular equipment.

Rust and Grease Remover

Sol Klean rust and grease remover is a patented material composed of phosphoric acid and solvents, which it is stated, removes grease, dirt and also in the same operation, removes rust. Sol Klean is manufactured in two different types; that is, the wash-off type and the wipe-off type. The wash-off material is sold in concentrated form and diluted with two or three parts of water. It is brushed on and then rinsed off with hot water at an approximate temperature of 140 deg. The wipe-off material is sold in concentrated form and is diluted with two to three parts of water. It is brushed on and immediately wiped off. After sufficient time has been allowed for the surface to thoroughly dry, it is ready for painting.

Sol Klean is manufactured by Industrial Chemical Products Co., 3777 Bellevue Ave., Detroit, Mich.

Metal Coating

This product was developed to eliminate the labor of chiselling, filing, scraping and cleaning the welding spatter from the parts adjacent to welds. Its use also lessens the chance of hard metal particles damaging gears and moving parts in axles, etc.

Wayne Metal Coating is furnished in the form of a very light jell that may be applied by brushing, dipping or spraying. It contains water and instantly cools the hot welding sparks as they hit and prevents them from attaching themselves to the covered surfaces. Parts may be easily cleaned with hot water or cleaning solution.

This coating is made by the Wayne Chemical Products Co., 9502 Copeland, Detroit, Mich.

Safeguarding Finished Metal Surfaces

For protecting highly-polished, painted, plated or Duco-finished metal surfaces from scratches, dulling or corrosion or tarnishing during storage, handling, fabrication and transit, the Haydn F. White Company, 415 Newman-Stern Bldg., Cleveland, Ohio, offers a liquid known as "Protex." This is brushed or sprayed on the surface to be protected and is then preferably covered with kraft paper. It is stated that the liquid quickly sets to a moisture-proof, coherent, tough skin which is opaque to light and a good insulator of low-voltage electric current. The skin readily peels off with the kraft paper, or may be easily pulled off if the kraft paper method is not applicable; leaving the metal in its original polished finish. Sprayed or brushed on parts and assemblies in storage, it prevents rust or corrosion; and it may be used to protect disused equipment till needed. Special types, such as alkali and acid resisting forms, may be supplied to fit individual needs. It is further stated that Protex-protected sheets may be stamped or pierced without removing the coating, provided of course that the dies are given the necessary extra clearance.

Motor Driven Polishing Lathes

A line of motor driven polishing lathes called the Reliance has been placed on the market by Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill. These lathes are of the overhanging spindle type allowing greater freedom for handling large work. They are equipped with spindle brake, automatic shut-off switch and flat top for shelf space, and can be supplied with one or two speeds at the same price. They use V-belt drives and any spindle speed can be obtained by the use of the requisite size motor pulley. The lathe employs a starting switch with push button control and overload and underload protection, as standard equipment. Speeds vary from 1800 to 3000 R.P.M.

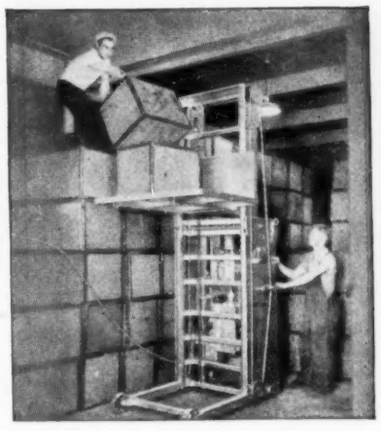
Reliance motor driven polishing lathe

Portable Electric Lifter

A new portable electric lifter for material handling, offering safety features and embodying a number of innovations in design, is pictured here. Two heavy duty roller chains, either of which can handle the limit capacity load alone, are used for lifting the platform.

A safety hinge is employed for passing through doors and moving under overhead obstructions, enabling the operator to fold over the top section with a few easy turns of a convenient handle. It is impossible for the top section to fall and cause injury to the operator or damage to the machine.

The unit comes in all sizes up to 30 feet high and with all capacities up to 10,000 pounds. It is powered with motors of any current characteristics. Hand and hydraulic lifters are also available. Made by the Service Caster & Truck Co., 909 N. Brownswood Ave., Albion, Michigan.



Service portable electric lifter

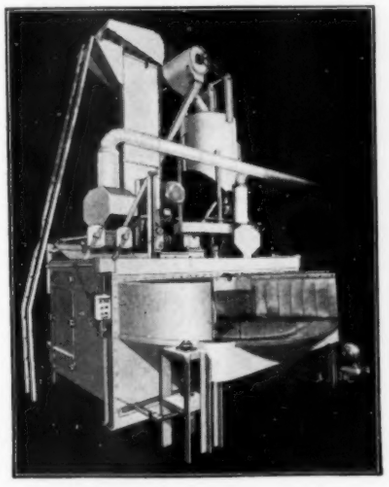
Wheelabrator Tablast for Cleaning Stove Plate

A new, specially designed Wheelabrator Tablast has just been announced by The American Foundry Equipment Company, 408 South Byrkit Street, Mishawaka, Indiana, for handling both the rough blasting and finish blasting operations required for cleaning stove plate prior to enameling, painting, japanning, etc.

One of the principal advantages claimed for this machine is that it will reduce cleaning costs by eliminating breakage and by eliminating compressed air equipment.

The "heart" of this new machine is the American Wheelabrator airless abrasive blasting unit. Two of these units are mounted in such a position that work passing through the blasting zone is completely showered by a continuous blast of steel shot or grit.

The illustration shows a complete Wheelabrator Stove Tablast. Work to be cleaned in this machine is carried through the cabinet on four tables, each 48″ in diameter. These tables are mounted on a main spider which carries them in and out of the cleaning cabinet. Rubber covering over the tables shields the metallic surfaces from blasting wear. As the tables pass through the blasting zone they are caused to revolve so that every surface of the work is fully exposed to the action of the abrasive.



Wheelabrator Tablast for stove plate

When work is being cleaned for finish enameling, an electrically timed indexing system controls the movement of the tables in and out of the blasting zone. Each table rotates for a predetermined length of time under the blast so that the work is given a thoroughly intensive cleaning.

Reports on Polishing Wheel Bond

The J. J. Siefen Co., 1936 W. Lafayette Blvd., Detroit, Mich., exclusive manufacturers of Nuglu, the synthetic glue, reports the following progress this product is making in plants that have adopted Nuglu. Some plants in their reports claim it is the best polishing wheel bond ever used and that not one wheel burned in all tests made so far.

Plant No. 1 reports: They polished 1,629 knives per wheel set up with Nuglu and No. 240 grit. They operated this test for four days and the above is the average per wheel. This is nearly double their former production per wheel.

Plant No. 2 reports: Nuglu set up wheels have averaged 17 fenders per wheel, which is nearly 2½ times more fenders per wheel than they polished before they adopted Nuglu. Not one wheel burned.

Plant No. 3 reports: They are getting about 200% more production per wheel set up with Nuglu and No. 360 grit, which is put on wheels in paste form for polishing cutlery. In addition they claim they are getting a better finish than they ever had before.

Plant No. 4 reports: On finish polishing steel radiator grilles they are getting over twice as many grilles per wheel than was possible with wheels set up with other bonds. They have not burned or scorched a wheel in 2 months. The polisher's brick they bought from us to clean the wheels of grease has helped considerable to get them this increased production.

Miniature Ingots Check Up On Electrical Alloy Characteristics

A miniature ingot known as a "coupon" and cast at the time the large production ingots are being cast, serves as a positive check on every batch of Nichrome and other electrical alloys produced in the Driver-Harris Company's plant at Harrison, N. J. As the "heat" is being poured into tall ingot molds, a worker introduces a small oblong ladle under the spout and gathers several pounds of alloy to form the sample ingot. Metal strips carrying identification numbers are inserted in the "coupon" ingot and corresponding production ingot alike, assuring positive and permanent identification.

The "coupon" ingot provides for the necessary chemical, mechanical and electrical

tests while production ingots are set aside pending the findings by the technicians. The "coupon" ingot is drilled to obtain sample filings for chemical analysis, whereby to determine the proportion of the various essential metals as well as the impurities if any. The tiny ingot may even be processed to wire of proper size and a life test made. If such test shows the wire to be up to standard, the corresponding ingot or ingots from the same "heat" may then be released for production. Otherwise, the ingots are rejected.

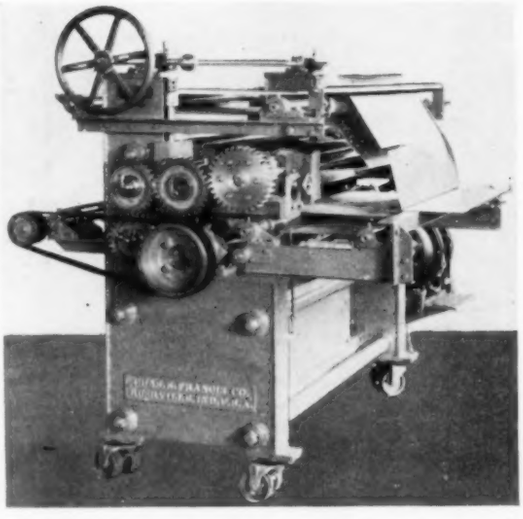
With hundreds of "coupon" ingots available in the chemical and metallurgical laboratories the Driver-Harris technicians keep in close touch with foundry and other plant operations, and have a handy "file" of the alloys being produced for electrical heating units and other critical functions.

Metal Coating Machines

A line of machines for coating metals is manufactured by Chas. E. Francis Co., Rushville, Ind., known as Model S-P. The feature of these machines is accessibility for cleaning. Bearings are of the two-screw split type and the rollers can be taken out by simply removing four end screws. The end seal plates can be removed by simply lifting them out of place, as they are maintained in position by the motion of the rolls only.

In order to eliminate a separate pan or trough, the coating material is carried in a trough formed by the crotch between the doctor roll and applying roll which is sealed at the ends by means of removable seal plates. When the machine is made for single coating the bottom roll acts as a feed roll only.

The model shown in the illustration is fitted with casters for portability. This machine is a 48″ single coater and is equipped with a special conveyor; weight about 3,500 pounds.



Francis Model S-P coating machine

Portable Hacksaw Machine

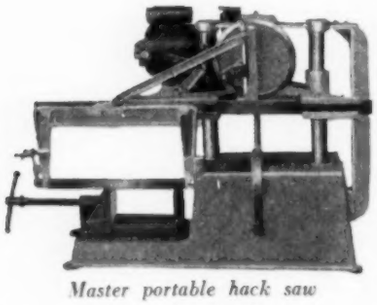
The Master Machine Co., 872 W. North Ave., Chicago, Ill., has recently perfected a portable hacksaw machine in which is incorporated new features in metal cutting.

A new movement is designed to automatically determine the exact pressure required to cut any degree of hardness in metals and to hold the saw at any position without danger of its falling. No oil, grease or liquid is required at blade contact and it allows for high speed of operation without overheating the saw blade or stock. The cutting movement is without vibration, to eliminate chatter marks on metal and it is said to be so uniform that thin tubing can be cut without bruising or tearing. The machine will cut round or square stock up to 7″ in diameter and up to 5″ stock can be cut at a 45 degree angle by the simple adjustment of the vise.

The saw frame travels in fifteen inches of bearing and is guided at top and bottom by a steel bar passing through a bronze fork. This principle insures precision cutting and eliminates cutting variance to less than one thousandth of an inch.

The saw clears the cut 1/16″ on its return stroke. Chip interference is completely eliminated because the saw comes into work from a cam action and the forward teeth will take out the chips before all the teeth reach the work. The hardness of the metal determines how far the teeth will penetrate and with the 125 lbs. gravity feed there can be no overload on the saw blade at any time. Provision is made to change the length of the stroke to 2″, 5″, 6″.

This portable machine can be used on the floor or bench in any shop, steel yard or warehouse whether equipped with electricity or not.



Master portable hack saw

Base for Lubricants

For the lubrication of aluminum, brass and other metals for drawing, stamping and extrusion, diglycol stearate is said to be arousing considerable interest.

Neutral, stable, non-toxic and easily compounded lubricating compounds are very quickly made with diglycol stearate as a base. If desired, the slight film which sometimes remains after working the metal is very easily removed with warm water. No solvents are necessary. The use of diglycol stearate, it is stated, permits the drawing of 0.01 gauge brass up to six stages with subsequent stamping without the necessity for further lubrication. In many cases, diglycol stearate has been found to decrease the wear on the dies. Cleaner and longer extrusions permanently free of acid or alkali stains are obtained.

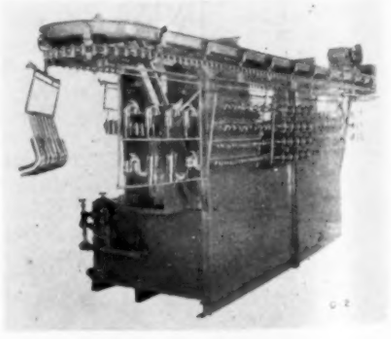
The manufacturers are Glyco Products Co., Inc., 148 Lafayette St., N. Y. C.

Tripoli Remover

Metalwash Machinery Company, Inc., 117-119 E. 24th St., New York, has built a special type of washing machine called a "Tripoli Remover." It was developed especially for the purpose of removing tripoli, rouge and other buffing and polishing compounds from racked parts prior to plating in order to eliminate the necessity of hand soaking or scrubbing; also to clean the work at lower cost.

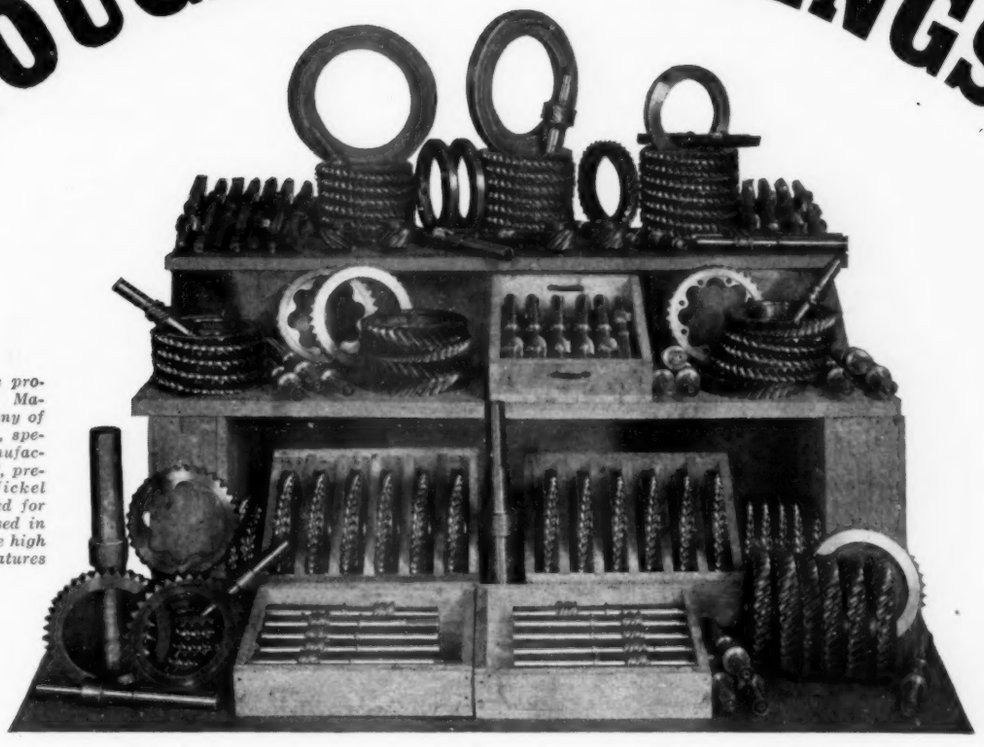
The machine provides an alkali wash. It is equipped with a variable speed conveyor so that varying washing times can be obtained on different classes of work. The machine will handle a wide variety of pieces of different sizes and shapes and also will wash all different types of metals, such as steel, brass, die castings, etc. It can also be arranged with a return type conveyor for use in straight line operation, or to return the work to the original loading point, thus making it possible for only one operator to handle the output.

The unit illustrated is one of a series which has been designed for this type of work, ranging in size from a small semi-automatic unit for use in job shops and small plating departments, up to and including large machines for use in connection with full automatic plating conveyors. Steam is recommended as the best heating medium but gas or electricity can be employed if desired.



Metalwash "Tripoli Remover"

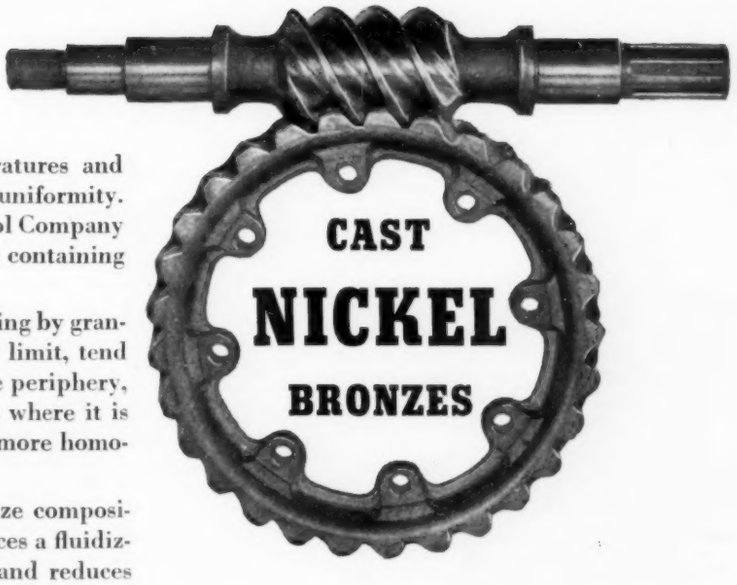
TOUGHER CASTINGS...



Worms and gears produced by Baush Machine Tool Company of Springfield, Mass., specialists in the manufacture of high-speed, precision gears. Nickel bronze is employed for all gears to be used in applications where high speeds and temperatures prevail.

..FEWER MIS-RUNS

Well-known gear maker improves castings and reduces foundry losses by adding Nickel to bronze



Bronze worm gears subjected to high temperatures and speeds need exceptional strength, toughness and uniformity. To assure these qualities, the Baush Machine Tool Company of Springfield, Mass., employs a bronze mixture containing 1½% Nickel.

Gears cast in this Nickel bronze, instead of failing by granular disintegration when stressed beyond their limit, tend to peen out at the ends of the teeth. Chilled at the periphery, the Nickel bronze provides increased hardness where it is most needed. In addition, the alloy is stronger, more homogeneous, and results in fewer foundry losses.

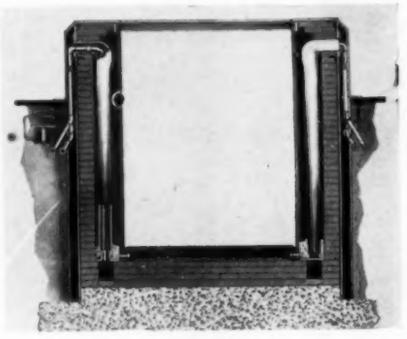
A small percentage of Nickel added to bronze compositions increases strength and toughness and induces a fluidizing effect which facilitates casting operations and reduces mis-runs. Consultation on casting problems involving the application of Nickel is invited.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Vertical Tube Type Hot-Dip Galvanizing Furnace

A new type of hot-dip galvanizing furnace has been developed by Lee Wilson Engineering Co., 1370 Blount St., Cleveland, Ohio. Major advantages claimed for this furnace are as follows:

1. No possibility of flame impingement on the kettle.
2. Close temperature control due to low heat capacity of setting.
3. Close control of heat input from top to bottom of the kettle.
4. Close control of heat input from end to end of the kettle.
5. Low dross loses.
6. Long kettle life.
7. Low fuel cost.
8. Availability of either gas or oil.
9. Kettle can be replaced without disturbing the setting brickwork.
10. Compact setting.
11. Automatic electric ignition.



Lee Wilson hot dip galvanizing furnace

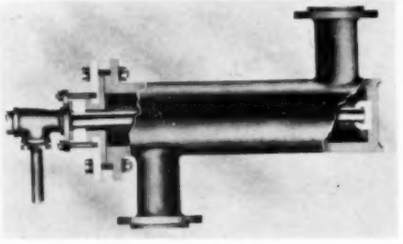
Acid Heating Unit

For heating acids or other severely corrosive solutions in circulation, the tantalum bayonet type heat exchanger has been developed by Fansteel Metallurgical Corporation, North Chicago, Illinois.

The outer jacket through which the corrosive solution circulates may be made of rubber-lined steel, stoneware, fused silica, phenolic plastic, or any material suitable for the specific requirement.

The heating unit is a tantalum "bayonet," a simple tube closed at one end, flanged at the other for connection to a base metal tee through which steam is introduced and condensate drained. The heat exchanger may be installed either horizontally or vertically. When installed vertically, the tee connection is at the bottom, so that condensate drains by gravity.

Tantalum is an elementary metal totally inert to practically all acids except hydrofluoric. In the presence of liquids which do not form scale, it is characterized by an exceptionally high rate of heat transfer.

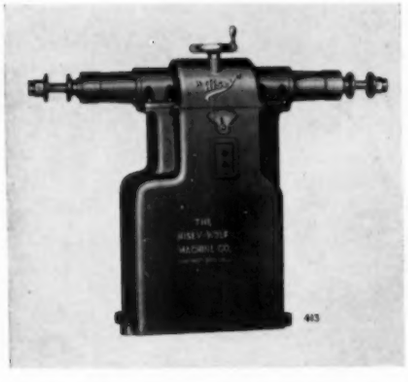


Fansteel bayonet acid heating unit

Tests with hydrochloric acid have shown coefficients as high as 4,000 B.t.u./sq. ft./deg. F./hour. Since tantalum is as strong as steel, high steam pressures, which contribute to higher heating efficiency, may be used.

Heat exchangers of this type are designed according to the nature and amount of liquid, the rate of flow, input and output temperatures, and available steam pressures.

Variable Speed Polishing Machine



Hisey-Wolf variable speed polishing machine

A new buffing and polishing machine with infinitely variable speed has been designed by the Hisey-Wolf Machine Co., Cincinnati, Ohio. Simply by turning the hand wheel at the top any desired spindle speed from 1700 to 3500 R.P.M. can be quickly obtained. The speed is changed while the spindle is in motion and can also be changed while the machine is actually under a working load.

Changes of speed require 11 seconds from extreme low to extreme high or vice versa.

The lathe is made in 3, 5 and 7½ H.P. capacities and can be furnished with any NEMA motor for any electrical characteristics. The speed dial plate in front of the machine is direct reading, indicating the R.P.M. of the spindle.

Tinning Material

In our March issue on page 139 we described a new tinning material called, "Tin-It," made by the American Fluresit Co., Inc. By a typographical error, the address of this company was given as Cleveland, Ohio. The correct address is 635 Rockdale Ave., Cincinnati, Ohio.

New Metal Coating Process

Calibron Products, Inc., West Orange, N. J., have recently published their Note Book No. 4, describing metal coating processes, divided into the following sections:

1. Methods Now Used
2. A New Development
3. Diffusion of Metals
4. Iron-Aluminum-Chlorine Reactions

The booklet is written by Edwin D. Martin, Vice President and Director. It describes a new method of coating which depends upon the chemical reaction between the metal surface and a volatile salt containing the metal to be deposited. The properties of this metal coating, it is stated, are better than those produced by electroplating, hot dipping, spraying, etc. The coatings are said to be very tenacious and bright, usually forming alloys, by replacement of the base metals. Some discussion is included on the possibility of coating metals with aluminum.

Oil Fired Heater

A new Despatch oil fired heater is of the convected air, recirculating type, built to enable owners of ovens, dryers, and tempering furnaces with obsolete and inefficient heating systems, to modernize at a very low cost, and obtain much improved results. Following are some of the claims for this oven:

Processing time is cut in half.

Operating costs are reduced, sometimes as much as 65%.

Better results are obtained, because convected air heating and recirculating permits better heat distribution and circulation.

Easily installed because it is externally mounted, this new heater is adapted to all types of ovens and tempering furnaces.

Recommended for core and mold ovens, for various finish baking and drying ovens, for dehydrating, for moisture and solvent drying, for tempering and drawing furnaces, for preheating ovens and furnaces, for solder sweating ovens and numerous other heat applications.

This heater is made by the Despatch Oven Co., 622 Ninth St., Minneapolis, Minn.

Despatch oil-fired heater

What the Reader Says

Of Interest to Manufacturers Who Wish to Sell in Australia

Editor METAL INDUSTRY:

We have been subscribers to your journal for about three years and wish to take this opportunity of expressing our appreciation for the interesting and informative articles you have published in your paper; we attribute a certain amount of our recent success in developments in our plant to this source.

We are at the moment seeking another industry allied to our present trade and hope that your readers will be able to offer us some valuable assistance.

At present we have a small but efficient plant, for the manufacture of small chromium plated metal goods, but wish to produce other lines at present not manufactured in Australia, for which our existing plant, with possibly a few necessary extensions, would suffice.

Our plant at the moment consists of die-making equipment, metal folding machines, hand and power presses, a complete woodworking plant, spraying equipment, metal polishing and finishing lathes and a plating plant capable of producing all finishes with the exception of gold and iron deposition.

We also have a sales organization established in the capital cities of the Commonwealth of Australia, New Zealand, South Africa, and Colombo (Ceylon) and maintain our own staff of assemblers and wrappers.

We will be interested to receive full details and samples wherever possible of products that as yet are not manufactured or sold in Australia by American manufacturers, and for which they require facilities for either complete or partial manufacture. The arrangement could be either in the form of licensing or royalty and we now look forward to hearing from manufacturers who are interested.

To facilitate negotiations in this matter, we have requested our bankers to forward by ordinary mail to their agents, the National City Bank of New York, 55 Wall Street, New York, the necessary references and details to be made available should they be required.

As a guide to our ideas in the extension of our manufactures, we mention our interest in the manufacture of locks. As you are, no doubt, aware, South Australia is the center of the motor-body building industry in the Southern Hemisphere, and we are given to understand that at the present moment, the majority of the locks used for this purpose are imported from England and Germany, and we consider that with the assistance that an American manufacturer of this type can offer us, and with the plant we have available, we have every opportunity of securing the whole of this market and its immense possibilities.

STOKES & CURTIS Ltd.
Penny Place Box 858G
Adelaide, Australia

Watch for the Coming Issues of Metal Industry!

Our great trouble is that we never have enough room for all the articles which we are anxious to publish! Some of the features announced in previous months have had to be put off; for that reason they appear in these columns again.

In the meantime we have welcome newcomers. See the list below.

"*The Development and Use of Anaconda Electro Sheet Copper*," by A. L. O'Brien, Service Engineer, American Brass Company. Thin sheet copper in wide widths is being made electrolytically on a commercial scale as a result of years of intensive development.

"*Plating to Specification*," by Nathaniel Hall, Consulting Chemical Engineer.

How to plate to required thicknesses.

The importance and value of specifications.

"*Chromium Plating Small Articles in a Basket*" by E. F. Ingersoll, metal finishing consultant. An economical method of plating work which is expensive to rack or wire.

"*Technical Control of Electroplating Processes*," by S. C. Taormina, Technical Director, Platers' Research Company.

"*Galvanoplastic Reproductions from Metal Molds*," by George Schor, Electroplater and Finisher.

"*Hot Dip Galvanizing Practice*," by W. G. Imhoff, Consulting Engineer.

Watch for the Coming Issues of Metal Industry!

New Books

Platers' Guidebook, 1938 Edition, by T. H. Chamberlain and G. B. Hogaboom, Jr., Asciate Editors METAL INDUSTRY. Free to subscribers of METAL INDUSTRY.

The 1938 edition of Platers' Guidebook is now in an advanced state of preparation. A large number of new topics are in contemplation and while the exact contents are not yet fully decided upon, they will be chosen from among the following subjects:

Etching metals, definition of terms used in electroplating, determining thickness ot paint and lacquer coatings, voltage control generators, cuprous oxide rectifiers, replenishing the metal in cyanide baths, a list of chemicals, chemical formula and properties of chemicals used in metal finishing, sizes of main copper conductors, drying, solvent and vapor degreasing, stripping solutions, hard chromium plating, iron plating, measurement of metallic coatings including methods of testing, equipment and latest specifications, rochelle salt copper cyanide solutions, recovery of silver and gold solutions, jewelry finishes, lacquers, latest developments, color plating, analysis of solutions including determination of boric acid, measurement of pH to include the available methods and equipment, polishing, buffing and coloring, abrasive rolling and ball burnishing, cleaning metals, conversion factors, metric and U. S. units, specifications for plated coatings, electroplating solutions, metal coloring, lacquers and synthetic finishes, measuring thickness of electrodeposited coatings, current density of work being plated, tanks, analyzing plating solutions.

Subscribers are urged to write for their copies at an early date on the stationery of their firm.

Poor's Industry and Investment Surveys. Precious Metals NQ 6. The Precious Metal Mining Industry, issued February 4, 1938. Published by Poor's Publishing Co., 90 Broad St., New York.

This survey reflects the expanding production and prospects for lower labor and material costs of the precious metal mining industry. Retention of most issues is advised. Information also given on silver properties.

Procedure Handbook of Arc Welding Design and Practice. Fifth edition published by the Lincoln Electric Co., Cleveland, Ohio, 1,012 pages and 1,243 illustrations.

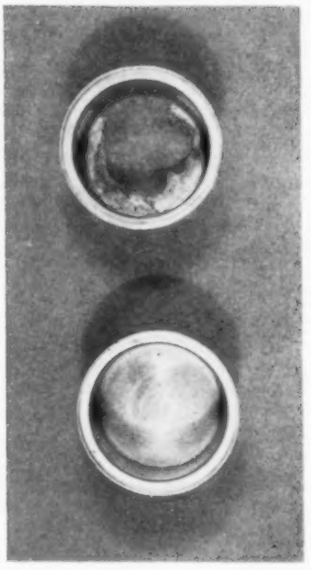
A complete arc welding reference guide, written especially for designers, engineers, production managers, welding supervisors and operators. The various sections of the book discuss methods, equipment, technique, speeds and costs, design and typical applications.

Swedenborg's Treatise on Copper. Published by the British Non-Ferrous Metals Research Association, Regnart Bldgs., Euston St., London, NW 1, England, in cooperation with the Swedenborg Society.

The British Non-Ferrous Metals Research Association, in co-operation with the Swedenborg Society, will shortly publish

Plating time cut 50% with better results!

A large manufacturer was experiencing trouble removing stamping oil from brass cups before cadmium plating. A 20-minute barrel plating would not thoroughly cover the insides of the cups (top cup in photo).



The cups are now cleaned with MAGNUS 94XX for 1½ minutes and barrel plated with cadmium for 10 minutes—plating time cut in half.

Result—the brass cups cleaned with MAGNUS 94XX (bottom cup in photo) has a good covering of cadmium (ten minute plating) on the inside as well as the outside, while the cup cleaned by a former method has very little cadmium on the inside.

Metal working and finishing manufacturers everywhere are asking for the details of these new MAGNUS X and XX Metal Cleaners (X-sudsing type, XX-non-sudsing type). Write for complete information today. You will benefit.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

11 South Avenue Garwood, N. J.

MAGNUS CLEANERS

a translation of Swedenborg's famous Treatise on Copper, "De Cupro," originally published in Latin in 1734. No translation has hitherto appeared.

This book gives an account of the smelting and refining of copper as practiced in many countries at the time; the production of brass; the nature of copper ores and their assaying; and various other matters pertaining to the properties of copper, its alloys, and its history.

Guides to Business Facts and Figures. Published by Special Libraries Association, 345 Hudson St., New York. Size 6 x 9, 59 pages, paper bound. Price $1.50.

An index and descriptive list emphasizing the best known business references and sources.

Proceedings of the American Society for Testing Materials for 1937. Published by the A.S.T.M., 260 S. Broad St., Philadelphia, Pa.

The 1937 *Proceedings* are published in two parts, Part I comprising committee reports (with appended papers) and new and revised A.S.T.M. tentative standards. Part II gives all technical papers including the Marburg Lecture. Part I has 1,365 pages. Price $5.50-$7.00 depending upon binding. Part II has 707 pages. Price $5.50-$7.00.

Location of Automotive Diesel Troubles Made Easy, by Victor W. Page. Published by Norman W. Henley Publishing Co., 2 W. 45th St., N. Y. Price 50c. A summary of the common derangements which interfere with efficient operation of all types of direct injection 4-cycle compression ignition motors.

Technical Publications

The Creep of Tin and Tin Alloys. Part II by Prof. D. Hanson and E. J. Sanford. Series A. Number 71. International Tin Research & Development Council, 149 Broadway, New York.

Discoloration and Corrosion in Canned Cream. Part II by C. J. Jackson, G. R. Howat and T. P. Hoar. Series A. Number 72. International Tin Research and Development Council, 149 Broadway, New York.

Production of Pressure Tight Castings in 30 Per Cent Cupro-Nickel, by T. E. Kihlgren, Metallurgist, Research Laboratories, International Nickel Co., Bayonne, N. J. Bulletin No. 404. Section II.

A method of foundry procedure for the production of pressure tight castings in 30 per cent cupro-nickel is described. It involves melting under slightly oxidizing conditions followed by oxidation of the melt and subsequent deoxidation (with both silicon and manganese in suitable amounts added 3 to 5 minutes before pouring). The simple 30 per cent nickel 70 per cent copper alloy, treated with silicon alone, while adequately killed, is sluggish to pour due to a tendency to form a tough film or envelope about the stream of molten metal. This tendency is neutralized by the co-presence of manganese, one per cent of the latter being quite adequate to impart excellent fluidity with silicon ranging from 0.25 per cent up to at least 1 per cent. Sound pressure tight castings are readily obtained by the simultaneous addition of 1 per cent manganese and as little as 0.25 per cent of silicon. However, higher silicon contents (0.25 to 0.75 per cent) may be used in conjunction with 1 per cent of manganese for the purpose of improving the strength properties while still retaining quite high ductility. Lead is a decidedly dangerous impurity in silicon content cupro-nickel causing "leakers" and hot cracking, and should be virtually absent. The effect of other elements such as zinc, tin, iron, etc., on the castability and physical properties is developed briefly in the paper. The method of feeding the castings as well as the pouring temperature has a marked effect on the quality of castings. Photographic illustrations of castings made under various conditions from 150 to 250 lb. experimental foundry heats are included to demonstrate the importance of controlling these factors.

Government Publications

Methods for Protection Against Silicosis and When They are Justified, by D. Harrington. I.C. 6989. U. S. Bureau of Mines, Washington, D. C.

Some of the Results of Recent Research on the Control or Prevention of Silicosis, by D. Harrington. I.C. 6994. U. S. Bureau of Mines, Washington, D. C.

Aluminum Industry in 1937—Final Annual Figures M.M.S. 617. U. S. Bureau of Mines, Washington, D. C.

The Use and Care of Respirators; including a list of respiratory protective devices approved by the U. S. Bureau of Mines. Preventive Engineering Series, Bulletin No. 2, Part 2. Air Hygiene Foundation of America, Inc., Pittsburgh, Pa.

Dust Sampling with the Bureau of Mines Midget Impinger, Using a New Hand Operated Pump, by J. B. Littlefield and H. H. Schrenk. R.I. 3387. U. S. Bureau of Mines, Washington, D. C.

Control of Dust from Blasting by a Spray of Water Mist, by Carlton E. Brown and H. H. Schrenk. R.I. 3388. U. S. Bureau of Mines, Washington, D. C.

Associations and Societies

American Electro-Platers' Society

Secretary, W. J. R. Kennedy, 90 Maynard St., Springfield, Mass.

We have the following "Convention Notes" from *Robert B. Goodsell*, chairman of the Publicity Committee for the coming convention of the American Electro-Platers' Society, to be held in Milwaukee. These Notes speak for themselves!

American Electro-Platers' 1938 Convention,
June 13th to 16th, please give your attention.
Now Brother Platers put by all fears,
This will be one of the biggest events in years.

You should know what this all has meant,
The Committee working hard for your entertainment.

They are doing their level best,
The ball game for the East to beat the West.

This game is planned to be a peach,
To be held at beautiful Waukesha Beach.
The shores of this beautiful lake are enchanting,
At night this resort is for your dancing.
This beach is only a little way out,
When you see this place you're going to shout.
I'll say the Entertainment Committee used their brains,
Now for these four days you'll be glad you came.

If you don't come, it will make you burn,
For the things you missed and failed to learn.

Other Convention practices have passed and died,
But at this one, Shop Visitation will be revived.

And when it's all over, for home you'll hate to start,
Milwaukee has a welcome that comes from the bottom of their heart!

Plans for the Convention are maturing rapidly. The program for the educational session as arranged to date will include the following:

Individual Papers

Walter Meyer, General Electric Co., Bridgeport, Conn. Subject—*The Effect of Metallic Impurities on the Structure of Cyanide Copper Deposits.*

George B. Hogaboom, Hanson - Van Winkle-Munning Co., Matawan, N. J. Subject—*History of Metal Coloring.*

Floyd Oplinger, R & H Chemicals Div., of duPont Co., Niagara Falls, N. Y. Subject—To be announced.

Gustave Soderberg, Udylite Co., Detroit, Mich. Subject—*Bright Nickel.*

W. Pinner and *G. Borchardt*, General Spring Bumper Co. Subject—*Importance of Correct Anode Corrosion in Electrodeposition of Nickel.*

Ed. Bucy, Zapon Div., Atlas Powder Co., Stamford, Conn. Subject—*Industrial Finish Manufacture.*

Dr. Mitchell, Magnus Chemical Co., Garwood, N. J. Subject—*Use of Solvent Emulsions in Metal Cleaning.*

Dr. Wm. Blum, Bureau of Standards, Washington, D. C. Subject—*Report.*

Paul Strausser, A.E.S. Research Fellow, U. S. Bureau of Standards. Subject—*Report.*

Branch Papers

Anderson: *Rochelle Salts-Copper Cyanide Solution.*

Detroit: *Electroplating Solves Manufacturing Problems.*

Newark: *Wetting Agents in Plating Solutions.*

Springfield: *Answers to 101 Questions on Copper Plating.*

Hartford: *Dips and Their Uses in the Plating Cycle.*

Philadelphia: Title Unannounced.

Boston: Title Unannounced.

Waterbury: Title Unannounced.

Dayton: Title Unannounced.

Entertainment

A picnic will be held at Waukesha Beach, a few miles out of Milwaukee where swimming and dancing can be enjoyed. The base ball game between the East and the West will be revived. *Tom Trumbour* of METAL INDUSTRY will be captain for the East and *Jack Geissman* for the West. *Cyanide Bill Schneider* will be the official umpire. A wild and woolly time is confidently expected.

SPEC GOLDGLO

(Patent Pending)

The Beautiful, Luxurious Imitation Gold Plate

Appearance is a highly important sales factor—GOLDGLO gives your product the magnetic glamour of gold that builds sales volume.

GOLDGLO makes possible the use of a gold finish on articles whose price range prohibits the use of actual gold. The 18 kt. color of GOLDGLO is rivalled only by gold itself.

GOLDGLO is economical to use and easy to operate. It plates directly over brass, copper, nickel, german silver, iron and steel; it also plates over all hard solders, and a majority of soft solders.

GOLDGLO has extremely high throwing power. It penetrates to remote recesses to plate as evenly as on flat surfaces.

Made by the makers of SPEKWITE.

Write for additional information.

SPECIAL SPEC CHEMICALS CORP.

SPECIAL CHEMICALS CORP.

30 Irving Place • New York, N. Y.

Your Product Must Not Only *Be* Good—It Must *Look* Good!

BOOKS FOR THE PLANT LIBRARY

A brief list of up-to-date books for the operating man in metal fabrication, assembling, plating and finishing as chosen by the editorial staff of METAL INDUSTRY.

BOOK ORDERS ARE PAYABLE IN ADVANCE

PLATING and FINISHING

Platers' Guidebook, 1938 Edition, by T. H. Chamberlain and G. B. Hogaboom, Jr., Associate Editors METAL INDUSTRY. Free to subscribers of METAL INDUSTRY.

The 1938 edition of Platers' Guidebook is now in an advanced state of preparation. A large number of new topics are in contemplation and while the exact contents are not yet fully decided upon, they will be chosen from among the following subjects:

Etching metals, definition of terms used in electroplating, determining thickness of paint and lacquer coatings, voltage control generators, cuprous oxide rectifiers, replenishing the metal in cyanide baths, a list of chemicals, chemical formula and properties of chemicals used in metal finishing, sizes of main copper conductors, drying, solvent and vapor degreasing, stripping solutions, hard chromium plating, iron plating, measurement of metallic coatings including methods of testing, equipment and latest specifications, rochelle salt copper cyanide solutions, recovery of silver and gold solutions, jewelry finishes, lacquers, latest developments, color plating, analysis of solutions including determination of boric acid, measurement of pH to include the available methods and equipment, polishing, buffing and coloring, abrasive rolling and ball burnishing, cleaning metals, conversion factors, metric and U. S. units, specifications for plated coatings, electroplating solutions, metal coloring, lacquers and synthetic finishes, measuring thickness of electrodeposited coatings, current density of work being plated, tanks, analyzing plating solutions.

Subscribers are urged to write for their copies at an early date on the stationery of their firm.

Principles of Electro-Plating and Electro-Forming (Electrotyping). Revised Edition. Dr. W. Blum and G. B. Hogaboom. Size 6 x 9 inches; 356 pages. Price $4.50.

Most of the book is devoted to the practical aspects of plating and gives not only general methods, but details, such as formulae for solutions, recommendations for equipment, both electrical and non-electrical, a description of the methods and chemicals used in cleaning and preparing the work for a metallic coating. Solutions described include the following: Copper, chromium, nickel, cobalt, iron, zinc, cadmium, lead, tin, silver, gold, platinum and alloys such as lead-tin, brass, etc. A number of valuable tables are appended and descriptions of typical experiments to teach the reader how to carry on investigations of his own. The book is authoritative and of exceptionally high character.

Metal Coloring. A. H. Hiorns, 4½ x 6¾ inches; 324 pages. Price $2.40.

A treatise covering the production of every shade of color which can be produced on metals. Discussed under, 1, chemical metal coloring; 2, electro-chemical metal coloring; 3, mechanical metal coloring.

Industrial Electrochemistry, by C. L. Mantell, Ph.D. Published by McGraw Hill Book Company. Size 6 x 9, 528 pages. Price $4.50.

Broadly inclusive of both the theoretical and technical sides of electrochemistry including some of the engineering aspects of electroplating. A text book for chemical engineers as well as a reference work for industry.

Chromium Plating with Special Reference to Its Use in the Automobile Industry, by Prof. Dr. Ing. E. H. O. Bauer, Professor H. Arndt and Dr. Ing. W. Krause. Translation from the German by E. W. Parker. Size 6 x 9, 266 pages. Price $9.50.

The data assembled in this book is from the report of an investigation carried out under the German Government sanction in collaboration with the State Association of the Automobile Industry. This investigation was carried out with the commendable object of "securing data of a reliable and unbiased character which could be placed at the disposal of industry with a view to raising the general standard of commercial plating."

METAL INDUSTRY, 116 John Street, New York, N. Y.

Boston Branch, A.E.S.

Secretary, Andrew W. Garrett, 100 King St., Dorchester, Mass.

The Boston Branch of the American Electro-Platers' Society held its annual banquet and open technical session on Saturday, February 26, at the Hotel Bradford. The technical session which began at 2 P.M. consisted of the following papers:

New Items in Metal Finishing, by Dr. Gustave Klinkenstein, Maas & Waldstein Company, Newark, N. J.

A New Talk on Nickel by Walter Meyer, General Electric Co., Bridgeport, Conn.

A Practical Demonstration of What Actually Happens in a Plating Barrel Under Various Conditions, by Dr. Bert Daw, Lasalco, Inc., St. Louis, Mo.

The number of papers presented at this session was intentionally small in order to allow sufficient time for the discussion which was active and interested. After 5 o'clock the meeting was given over to a discussion of the welfare of the A.E.S. and the Boston Branch.

The banquet was held at 7 P.M. and was followed by a Floor Show of the most entertaining type. Seven "all-star" acts were presented to the 200 members and guests who were present. Congratulations were tendered on all sides to the Banquet Committees for providing such an excellent day of education and entertainment.

Bridgeport Branch, A.E.S.

Secretary, W. H. Flaherty, 691 Maplewood Ave., Bridgeport, Conn.

The annual educational session and banquet of the Bridgeport Branch of the American Electro-Platers' Society will be held at the Stratford Hotel, Saturday, April 30th. The educational session will begin at 2:30 P.M. and the following papers will be delivered:

"*Silver Plating*" by Donald Wood.

"*What Research Has Done for Electroplating*" by George B. Hogaboom.

"*A Chart of the Chemical Elements for Electroplaters*" by George Dubpernell.

The banquet will begin at 7 P.M. and will be followed by a floor show and dancing. Tickets $2.50.

Newark Branch, A.E.S.

Secretary, George Wagner, 1130 S. Long Ave., Hillside, N. J.

The Newark Branch of the American Electro-Platers' Society will hold its annual open educational session and banquet on Saturday, April 23rd, at the Hotel Douglas. The educational session will start at 2 P.M. and the following speakers will present papers:

N. Promisel, International Silver Co., Meriden, Conn.

Albert Hirsch, Snyder, Inc., Philadelphia, Pa.

E. N. Bucy, Zapon Co., Stamford, Conn.

T. H. Chamberlain, New Haven Clock Co., New Haven, Conn.

The banquet will be held at 7 P.M. Special afternoon entertainment will be provided for the ladies. Tickets $3.00.

Rochester Branch

Secretary, J. R. Elster, 295 Rawlinson Road.

The 19th Annual Educational Session and Dinner Dance of the Rochester Branch, A.E.S., will be held Saturday, April 30, 1938, at the Hotel Seneca. Tickets $2.50. The educational session which will begin at 1:00 P.M. will have the following program:

"*Modern Practice in Plating on Zinc Alloy Die Castings*" by Edmund A. Anderson, chief investigator of the New Jersey Zinc Co.

"*Buffing and Polishing Methods*" by R. E. Leather, president of the Lea Mfg. Co.

"*Notes on Bright Nickel Plating*" by Gustaf Soderberg, technical director, The Udylite Co., Detroit, Mich.

"*Rapid Deposition of Zinc from Cyanide Solutions*" by Floyd F. Oplinger, Research Supervisor, Electroplating Division, R & H Chemicals Dept., E. I. duPont de Nemours & Co., Inc.

Dinner will begin at 7 P.M.

All electroplaters, manufacturers and others interested in electroplating are cordially invited to attend.

American Zinc Institute

60 East 42nd Street, New York.

The 20th Annual Meeting of the American Zinc Institute will be held at the Hotel Statler, St. Louis, Missouri, on Monday and Tuesday, April 25th and 26th.

The program on Tuesday will include topics relating to developments in zinc coatings and the market for zinc coated products. Technical and operating men in the galvanizing division of the steel industry will join with us and share the platform.

Entertainment features will include the annual dinner which will be held on Monday evening.

The Galvanizers Committee Spring Meeting

Preliminary arrangements have been made for the Fourth Meeting of The Galvanizers Committee, which will be held at the Hotel Statler, St. Louis, Missouri, on Monday, Tuesday and Wednesday, April 25th, 26th and 27th.

On Monday afternoon the Committee will hold a Round Table conference, which will be open only to members of the Galvanizers Committee. On Monday evening there will be a dinner and entertainment for the members and guests of The Galvanizers Committee and the American Zinc Institute.

The subjects at the Tuesday afternoon session will be of prime importance to the galvanizers. There will be an informal smoker and get-together on Tuesday evening.

On Wednesday morning there will be a second closed session for the members of The Galvanizers Committee only.

Connecticut Non-Ferrous Foundrymen's Association

Secretary, Louis G. Tarantino, 670 West Jackson Avenue, Bridgeport, Conn.

This association held its regular meeting March 15, 1938 at the Hotel Duncan, New Haven, Conn. with President *H. A. Phelps* in charge. One of the largest attendance was present. The speaker was *E. Parker Mott* of the Metal Hose & Tubing Co. of Brooklyn, N. Y. and the subject was "*Modern Furnace Improvements & Refractory Insulations.*"

President Phelps appointed the Entertainment Committee for 1938 to consist of: *Fred B. Clarke*, Chairman, assisted by *L. G. Tarantino, S. W. Chappell, Jr., H. Dingee, F. B. Diana, T. Joseph Judge*, and *W. J. Kenney*. The committee is to arrange for the June entertainment meeting.

American Foundrymen's Association

Headquarters, 222 W. Adams St., Chicago, Ill.

The Foundry Show will be held in the Public Auditorium, Cleveland, Ohio, in conjunction with the 42nd Annual Convention, May 14-19, 1938. In the Cleveland Exhibition Hall, there are 20,000 sq. ft. more space available than have been used in other years. The American Foundrymen's Association reports that space already reserved proves that the industry is confident that the 1938 Show offers unusual opportunities.

All those interested are invited to communicate with *C. E. Hoyt*, Manager of Exhibits at the headquarters of the A.F.A., given above.

Why Not Avoid Metal Cleaning Head-aches?

You told your Architect and General Building Contractor what you wanted. You didn't keep busy yourself with transit, level and rule—but you made sure they did. You avoided many a headache and got more value for your money.

Why not tell us (or let us find out) what the possibilities are for improving your metal cleaning operations? Let us analyze the problems—such as cleaning equipment, fabricating compounds, metals being cleaned, water analysis, temperatures, time allowances, finishes. These details may be headaches for you, but they are all in the day's work for us.

With the numerous group of Wyandotte Metal Cleaners as our dependable kit of working tools, we undertake to give you the desired improvement or refund your money.

Wyandotte

District Offices in 28 Cities

Electrochemical Society

Columbia University, New York City.

At the coming Savannah, Ga., meeting, which will be held at the Hotel DeSoto, April 27-30, 1938, a session on Electrodeposition will be held which will include the following papers:

Commercial Electrodeposition of Cobalt-Nickel Alloys, by L. Weisberg.

Electrodeposition of Copper, Nickel and Zinc from Cyanide Solutions, by C. L. Faust and G. M. Montillon.

Anode and Cathode Weight Losses in Galvanic Corrosion, by W. A. Wesley.

Table of Electrochemical Equivalents, by G. A. Roush.

The Structure and Hardness of Electrolytic Chromium, by M. Cymboliste.

Causes of Porosity in Electrodeposited Coatings, Especially of Nickel on Steel, by A. W. Hothersall and R. A. F. Hammond.

Alkaline Plating Baths Containing Organic Amines; Part II. Copper Plating from Solutions Containing Ethylenediamine, by C. J. Brockman and John H. Mote.

Alkaline Plating Baths Containing the Ethanolamines; Part IV. Copper Plating from Monoethanolamine Solutions, by C. J. Brockman and C. P. Tebeau.

Electrodeposition of Manganese from Aqueous Solutions, by W. E. Bradt and L. R. Taylor.

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Our facilities cover every step in its production, from the mining of the chrome ore on a remote island in the Pacific to the wide distribution of the finished product through warehouse stocks in the principal consuming centers.

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Porcelain Enamel Institute

612 N. Michigan Ave., Chicago, Ill.

Charles S. Pearce has been appointed secretary of the Porcelain Enamel Institute, to fill the position vacated by George P. MacKnight. Mr. Pearce has had a wide range of experience in the manufacture of porcelain enamel and is consequently thoroughly familiar with the industry.

Battery Association

7 E. 44th St., New York.

The National Battery Manufacturers Association will hold their annual Spring Convention at the Statler Hotel in Cleveland on May 24 and 25.

Management, business practices, and merchandising will be among the other important topics on the program. And, as is usual with the Association, entertainment and recreation will have its part.

"Clinics" to Show Latest Welding Practice for Non-Ferrous Alloys

Latest developments in welding practice for non-ferrous alloys will be demonstrated at two "clinics" to be held in Atlanta, Ga. on April 15th and 16th and in New York on May 6th and 7th. Included will be practical problems involving the latest methods of both electric and oxyacetylene welding and brazing on Monel, aluminum, nickel, copper, brass, bronze, Inconel, and nickel-clad steel.

Both "clinics" will be conducted by welding engineers of The International Nickel Company, The Aluminum Company of America, the American Brass Company and Handy and Harman.

The clinic in Atlanta will be held in the warehouse of J. M. Tull Metal & Supply Company, 285 Marietta Street and in New York at the Whitehead Metal Products Company, Inc., 303 West 10th Street.

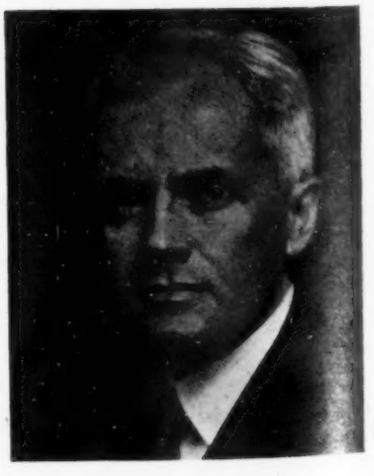
Personals

Dr. Merica Receives Fritz Medal

Paul Dyer Merica, vice president of the International Nickel Company, on March 17th, his 49th Birthday was the recipient of the 34th John Fritz Medal, in recognition of his "Important Contributions to the Development of Alloys for Industrial Uses," following a dinner given in his honor by the American Institute of Mining and Metallurgical Engineers, of which he is Vice President and a Director, at the Metropolitan Club, New York City.

Mr. Merica shares with the late Guglielmo Marconi the distinction of being the youngest to receive this award which is recognized as being the highest honor bestowed by the Engineering Profession. It is awarded jointly by the four national engineering societies: the American Society of Civil Engineers, The American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, and American Institute of Electrical Engineers. Dr. Merica was born at Warsaw, Indiana, March 17, 1889, the son of Charles Oliver Merica and Alice White Merica. His father was an educator and in the course of his career was president of several colleges and universities, including the University of Wyoming.

After leaving the Warsaw, Indiana High School, Paul Merica attended De Pauw



Dr. PAUL D. MERICA

University for three years, where he came under the influence of Dr. W. M. Blanchard, Professor of Chemistry, who awakened his interest in science, particularly chemistry. Later, he studied organic chemistry at the University of Wisconsin where he received his degree of A.B. in 1908.

At Madison he was an instructor under Professor C. E. Mendenhall in the Physics Department, and later became interested in teaching "Western subjects" in Chekiang provincial college at Hangchow, China, where he taught scientific mathematics and mechanical subjects for the next two years.

By chance, a copy of Desch's Metallography came into Dr. Merica's hands while he was in China, which led him later to follow metallurgy as a career, and in 1911 he went to Germany where he took his doctor's degree at the University of Berlin in 1913.

It was at the National Bureau of Standards, in his first professional job in the United States in the newly organized Division of Metallurgy under Dr. G. K. Burgess, that Dr. Merica in Scientific Paper 347, entitled "Heat Treatment of Duralumin," by Merica, Waltenburg and Scott, "fired the metallurgical shot that was heard around the world," according to Zay Jeffries, of the General Electric Company, of Nela Park, Cleveland, who made the presentation address at the dinner.

In his address introducing the Medalist, Dr. Jeffries told how the solution of this problem which was raised by Dr. Alfred Wilm in Germany while young Merica was a student in Berlin baffled all metallurgists. He said, "In Germany, Dr. Alfred Wilm had produced a new aluminum alloy Duralumin, which had strange properties. It contained about four per cent copper and one-half per cent each of magnesium and manganese. When mechanically worked and cooled rapidly from a temperature near 500 degrees Centigrade, its strength, if tested immediately was around 40,000 pounds per square inch. If merely allowed to remain at room temperature, the strength increased gradually to say, 60,000 pounds per square inch in about four days. The hardness and yield strength also increased markedly. Wilm did not know why his alloy behaved in this strange manner. The phenomenon was so puzzling, and so many metallurgists had sought in vain for a satisfactory explanation, that I was prompted to dub it at the time as the most baffling of the then current metallurgical problems."

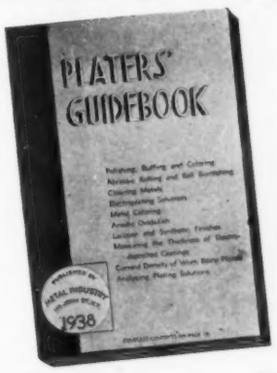
This problem was one of the first Paul Merica attempted to solve in his new position at the Division of Metallurgy in the Bureau of Standards, and together with R. D. Waltenberg and Howard Scott, had the solution by June, 1919. "It resulted in a new and fundamental metallurgical conception," said Dr. Jeffries, "now known as 'precipitation hardening,' which has had a profound influence on both theoretical and practical metallurgy."

A feature of the dinner, and a surprise to Dr. Merica was the presentation after the award of the John Fritz Medal, of a memento as a symbol of Dr. Merica's romantic association with precipitation hardening, which was prepared by some of his associates in the International Nickel Company, and friends in the Aluminum Company of America. It was a copy of a photograph taken of Dr. Merica about twenty years ago. The print was made on a sensitized sheet of one of the special precipitation hardened duralumin alloys. The frame was made of K-Monel, a metal originated by Dr. Merica, which is twice as strong and twice as hard as ordinary Monel metal—due to this principle of precipitation hardening. At the bottom of the picture, is the title—"Paul Dyer Merica—John Fritz Medalist—1938."

In his response after receiving the John Fritz Medal, Dr. Merica in urging a free industry and an eager industry, said, "It is important, particularly in times like these, that the public should know of the gifts it receives continually from scientific and engineering effort. There should also be a more popular recognition of how important it is to the body politic that the basic condition under which scientific and engineering creation prospers and finds realization in our economic life, should not be attacked or destroyed.

"This basic condition," he continued, "is surely an active and competitive industry as well as an eager industry, permitted the incentives to the support of engineering research and a free industry, strong enough to translate research into public wealth. Should industry ever be deprived of these characteristics, research will again return to its ancient academic quarters; and its value to society will rest in dusty volumes. Someone recently said that in a planned economy, Edison would have had a steady job—but the world would have gone unlighted."

R. C. Allen, Past President of the American Institute of Mining and Metallurgical Engineers, presided during the dinner, turning the meeting over to John M. Lovejoy, another Past President of the A.I.M.E. and chairman of the John Fritz Medal Award Board, during the ceremony of awarding the medal. Arthur S. Tuttle, chairman of the 1937 John Fritz Medal Award Board, which awarded the Medal to Dr. Merica, presented the medal.



SEVENTH ANNUAL 1938 EDITION

PLATERS' GUIDEBOOK

PUBLICATION OFFICE
116 JOHN STREET, NEW YORK

Contents Platers' Guidebook

THE CONTENTS OF THE 1938 PLATERS' GUIDEBOOK WILL COVER A VARIETY OF NEW SUBJECTS. THE FOLLOWING IS A LIST UNDER PREPARATION AT THIS TIME:

Etching metals
Definitions of terms used in electroplating
Determining thickness of paint and lacquer coatings
Voltage control generators
Cuprous oxide rectifiers
Replenishing the metal in cyanide baths
A list of chemicals, chemical formulae and properties of chemicals used in metal finishing
Sizes of main copper conductors
Drying
Solvent and vapor degreasing
Stripping solutions
Hard chromium plating
Iron plating
Measurement of metallic coatings including methods of testing, equipment and latest specifications
Rochelle salt copper cyanide solutions
Recovery of silver and gold solutions
Jewelry finishes
Lacquers, latest developments
Color plating
Analysis of solutions including determination of boric acid
Measurement of pH to include the available methods and equipment
Polishing, buffing and coloring
Abrasive rolling and ball burnishing
Cleaning metals
Conversion factors, metric and U. S. units
Specifications for plated coatings
Electroplating solutions
Metal coloring
Lacquers and synthetic finishes
Measuring thickness of electrodeposited coatings
Current density of work being plated
Tanks
Analyzing plating solutions

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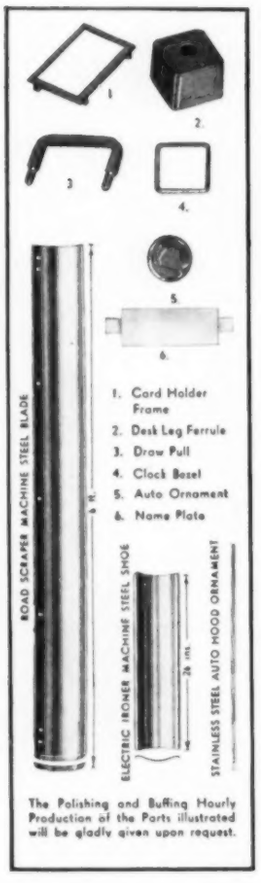
METAL INDUSTRY



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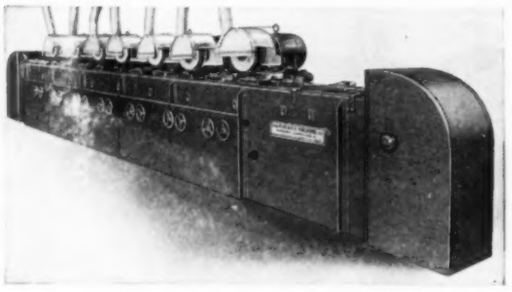

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Parts of varied sizes and shapes more uniformly finished, hourly production increased and with a substantial saving in finishing room dollars . . . PACKER Machines are made in 3 Types—Rotary —Straight Line Conveyor (shown above) and the Portable Vertical . . . No. 2 Straight Line (above) is entirely protected from abrasive dust—a new design by PACKER, the Pioneer manufacturer of Automatic Polishing and Buffing Machines.

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Edmund A. Anderson

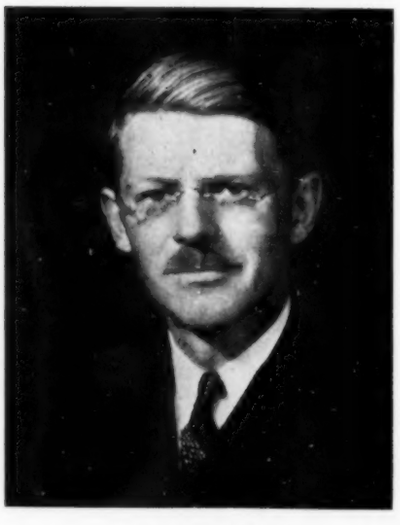
Edmund A. Anderson, chief investigator for the New Jersey Zinc Co., Palmerton, Pa., has the unique distinction of achieving prominence in two different divisions in the metal industries: metallurgical and electrodeposition.

Mr. Anderson was born in Bridgeport, Conn., July 27, 1899. He was graduated from Yale University in 1920 and after post graduate work received a Master of Science degree in Physical Metallurgy in 1923. At one time he held the position of physical metallurgist with Handy & Harman, Bridgeport, Conn., and in 1923 he joined the research staff of the New Jersey Zinc Company.

In 1928 he became chief investigator of the Metal Section of the Research Division. His special duties include work in zinc finishing, corrosion, alloy development, x-ray studies and spectrographic quantitative analysis. He has been responsible for the direction of the work in methods on electroplating best suited to zinc and in advocating the use of heavier, quality deposits of electroplated coatings of zinc.

Mr. Anderson also cooperated in the development of the Zamak die casting alloys by the Research Staff of the New Jersey Zinc Company.

Mr. Anderson is the author of a number of papers published in the technical society and industrial press. He is a member of the A.I.M.E., and of the Research Committee of the A.E.S.



E. A. ANDERSON

Magnus Appointments

Magnus Chemical Company, Garwood, N. J., manufacturers of cleaning materials, industrial soaps, sulfonated oils, emulsifying agents and metal working lubricants announce three appointments as follows: *Alfred L. Gough* becomes resident sales representative in the state of Rhode Island; *Jas. J. O'Keefe* becomes resident sales representative, covering the state of Virginia; *Linwood D. Knight* will represent Magnus in the state of New Hampshire. All three men have had much previous experience in the industrial field.

Hobart Company Personnel Changes

On February 2nd, the Board of Directors of the *Hobart Mfg. Co.,* Troy, Ohio, elected *John M. Spencer,* President. He succeeds the late President, *H. L. Johnston* who passed away on January 21st, following a prolonged illness. Mr. Spencer has been Vice President and General Manager of The Hobart Manufacturing Company since 1929. He will continue in his capacity as General Manager.

David Meeker, who was previously Vice President in charge of Research, was promoted to the Vice Presidency previously occupied by Mr. Spencer. He will continue as Director of Research for the Company. At the same meeting, *Edward S. Johnston,* son of the late president, was named as a Director of the Company, to fill the vacancy

JOHN M. SPENCER

caused by the death of his father. Mr. Johnston will continue in his duties as Factory Manager of the Company's Plant No. 3, located at Dayton, Ohio.

Metal Men Join Greater New York Fund

Well known metal industry men have joined with other business, employee and welfare leaders of the city in sponsoring a program for the financing and coordination of more than 800 private health and welfare agencies in New York City, according to an announcement by *James G. Blaine*, president of the Marine Midland Trust Company and president of the newly formed Greater New York Fund, Inc.

Metal industry representatives appearing on the Sponsoring Committee list are: *Cleveland E. Dodge*, vice president, Phelps Dodge & Co., a member of the board of directors; *William G. Creamer*, William G. Creamer & Co., Brooklyn, N. Y.; *Oscar C. Hoffman*, president, Continental Can Co., Inc.; *Walter P. Jacob*, president, General Bronze Corp., L. I. City.

H. Donn Keresey, president, Anaconda Wire and Cable Co., 25 Broadway, New York City, has been appointed associate chairman of the Committee on Contributions of the Greater New York Fund. New sponsors include *James L. Ashley*, vice-president, International Nickel Co., Inc.; *Otto Allen Barth*, president, Barth Smelting Corporation; *Louis S. Cates*, president, Phelps Dodge Corporation; *Richard O. Leongard*, vice-president, United Chromium, Inc.

D. M. Curry gave an illustrated talk before the Seattle Chapter of the American Foundrymen's Association on March 9th, 1938. During the course of his talk the speaker discussed the entire range of foundry practices relative to the successful casting of nickel-aluminum alloys, nickel bronzes, nickel silvers, pure nickel and Monel. Mr. Curry is a field (research) representative of *The International Nickel Company, Inc.*, 67 Wall St., New York.

G. L. Cox presented a paper, "*Some Uses of Metals in the Chemical Industry*" by F. L. LaQue on March 21, 1938, betore the Western Metals Congress, Los Angeles, Calif. This paper covered the uses and applications of aluminum and high aluminum alloys, copper and high copper alloys, nickel and high nickel alloys, precious and semi-precious metals, stainless steels, iron and steel and lead and high lead alloys in the chemical industry. Mr. LaQue and Mr. Cox are members of the Development and Research Division of The International Nickel Company, Inc.

Dr. H. W. Gillett, Chief Technical Advisor, Battelle Memorial Institute, Columbus, Ohio, has been chosen to deliver the 1939 Howe Memorial Lecture of the American Institute of Mining and Metallurgical Engineers. The Howe Lecture, established in 1923 in memory of Henry Marion Howe, Past President of the A.I.M.E., is given each year by someone of recognized, outstanding achievement in iron and steel metallurgy or metallography. The choice is made by the Board of Directors upon recommendation of the Iron and Steel Division.

Houghton Sales Staff

Revisions in sales divisions and the appointment of a new Assistant General Sales Manager have just been announced by *E. F. Houghton & Co.*, manufacturers of oils, leathers and metal working products, Philadelphia. *G. W. Pressell*, now Executive Vice-President, has also assumed the position of General Sales Manager. To assist him, *C. G. Schultze*, former Sales Manager, Central Division, has been named Assistant General Sales Manager. Advertising Department is headed by *D. C. Miner*. The Central Division has been divided into three sections: Pittsburgh, Detroit and Chicago divisions. Sales division heads are as follows: *H. E. Sanson*, Eastern Division; *W. H. Brinkley*, Southern Division; *A. A. Miller*, Western Division; *D. J. Richards*, Pittsburgh Division; *H. E. Martin*, Detroit Division; *E. C. Barlow*, Chicago Division. Departmental heads in the main office in Philadelphia are set up under a newly created position of Research Sales Manager, filled by *L. D. Holland*. *O. M. Gibson* is in charge of Metal Research.

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I. T. Darlington has been appointed Technical Director of the *H. V. Walker Company*, Elizabeth, N. J., manufacturers of lacquers, enamels and synthetic finishes. Mr. Darlington was formerly with the Egyptian Lacquer Mfg. Company.

C. F. Gross has been appointed sales manager of the *H. V. Walker Company*, Elizabeth, N. J., manufacturers of lacquers, enamels and synthetic finishes. Mr. Gross was formerly with the Egyptian Lacquer Mfg. Company.

The *Hammond Machinery Builders*, Kalamazoo, Michigan, announce the following appointments: *Arthur E. Smith*, 320 Jackson Building, Buffalo, New York, as their representative in Western and Central New York and *William C. Edgar*, Oliver Building, Pittsburgh, Pa., as their representative in Western Pennsylvania and Northern West Virginia. Both men will work in the sale of grinders for foundry use.

WINTHROP C. NIELSON

Obituaries

Winthrop C. Nielson

Winthrop C. Nielson, a vice president of the Aluminum Company of America, died at his Ardmore, Pa., home on March 12. He was 60 years old and had been in failing health for more than a year. Born in Philadelphia, Mr. Nielson attended the University of Pennsylvania, from which he was graduated in 1899.

Mr. Nielson held his present office since 1931, but was concurrently president of the Republic Mining and Manufacturing Company, a position which he occupied since 1906, when he succeeded his father. The company, then independent, subsequently became a subsidiary of the Aluminum Company. Mr. Nielson was a member of the A.I.M.E. and a number of trade and social organizations.

H. O. Fleischman

H. O. Fleischman, operator of the Central Brass Foundry, Toledo, Ohio, died February 16th, after a short illness, at the age of 59.

Arthur W. Ruttan, Sr.

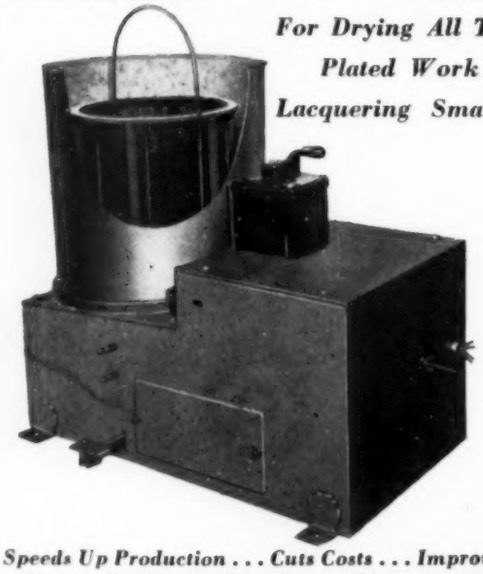
Arthur W. Ruttan, Sr., head of the Robinson Plating Works, Milwaukee, Wisc., since 1922, died on January 30th, aged 59 years. Mr. Ruttan was born in New York and moved to Milwaukee in his boyhood.

Verified Business Items

Stainless Metals, Inc., 225 Fifth Ave., New York, manufacturer of metal products, has leased one-story industrial building at 31-49 Twelfth Street, Long Island City, N. Y., for plant. Departments: drawing, pickling, spinning, stamping, soldering, brazing, welding, grinding, sand blasting, descaling, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, anodic treatment, lacquering, enameling and finishing. This firm reports using the following base metals: stainless steel and Monel.

KREIDER *Centrifugal* DRYER

For Drying All Types of Plated Work and Lacquering Small Parts



Speeds Up Production . . . Cuts Costs . . . Improves Quality

The new Kreider Centrifugal Dryer reflects our many years' experience in this field. It is the result of our engineers effort to produce the best. Although unusually simple in design and easily operated by one man, the Kreider Dryer speeds up production and improves the quality of the work.

An auxiliary steam heating unit can be supplied as standard equipment when drying parts which have a tendency to retain water and additional steam is needed in the drying operation. Reversing drum switch is supplied on all dryers.

Write for Complete Specifications and Prices

DELLINGER MANUFACTURING CO.
727 North Prince St. Lancaster, Pa.

METSO CLEANER
Reliable
AS YOUR TELEPHONE

"METSO CLEANER is the best thing we've ever used" reports a prominent stove manufacturer. This is why . . . Metso wets the grease more promptly, and lifts it off completely. Thus his rejects are fewer and he saves time. You can depend on Metso for reliable performance. Test it in your plant.

PHILADELPHIA QUARTZ COMPANY
General Offices and Laboratory: 125 S. Third St., Philadelphia, Penna.
Chicago Sales Office: 205 W. Wacker Drive. Stocks in 60 cities.
Sold in Canada by National Silicates Ltd., Toronto, Ont.

Steelweld Machinery Co., Cleveland, Ohio, manufacturers of press brakes, bulldozers, crank shaft twisters and special metal forming machinery, announces the appointment of *Lee B. Green* as general manager.

City Brass & Aluminum Foundry Corp., 424 S. Pennsylvania St., Indianapolis, Ind., recently has been incorporated by *Harry F. Menzel, J. J. Mitchum, M. P. Schaefer* and *F. M. Jones*, to operate a foundry. Departments: sand blasting, polishing, buffing, finishing, non-ferrous foundry. Principal base metals used: brass, bronze and aluminum.

National Transformer Corp., Jersey City, N. J., manufacturer of electrical transformers and parts, has leased one-story building at 224-34—21st St., Paterson, N. J., about 21,000 sq. ft. of floor space with option to purchase and will improve for new plant, expanding present capacity. Departments: stamping, welding, coloring. Principal base metals used: brass, steel.

F. L. Jacobs Co., 1043 Spruce St., Detroit, Mich., manufacturer of metal tubing, automobile cranks and other automotive products, has acquired *W. I. T. Mfg. Corp.*, College Park, Md., and its subsidiary, *Air-Track Mfg. Corp.*, same place, manufacturer of mechanical equipment and will consolidate. Departments: rolling, drawing, stamping, brazing, welding, grinding, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, lacquering, enameling and finishing. Principal base metal used: steel.

Electric Auto-Lite Co., Bay Mfg. Div., Bay City, Mich., manufacturer of gages and other precision instruments, has practically completed an addition to steam power house to include installation of a new 750-hp. boiler unit and auxiliary equipment; cost about $45,000. Departments: rolling, drawing, stamping, soldering, brazing, welding, grinding, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, anodic treatment, lacquering, enameling and finishing. Principal base metals used: brass, steel zinc and aluminum.

The Pioneer Engineering & Manufacturing Co., 31 Melbourne Ave., Detroit, Mich., manufacturer of positive-displacement coolant and lubricant pumps, has appointed the *Willis J. Stutson Co.*, 184 N. Wacker Drive, Chicago, Ill., as exclusive representative in the Chicago and Northern Illinois district. Departments operated: stamping, grinding, degreasing, machining. Principal base metals used: bronze, steel, nickel, iron, cast iron.

Pyrometer Instrument Company, 103 Lafayette St., New York, will have a full exhibit at the coming convention of the American Foundrymen's Association, to be held in Cleveland, May 14-19th. They will occupy Booth 23.

Battelle Memorial Institute, Columbus, Ohio, announces that for the third consecutive year, four appointments as research associates are being made available. These appointments are open to graduates of any accredited college or university. Preference will be given to men who have demonstrated marked aptitude for scientific research in their industrial experience or by graduate study in chemistry, physics, metallurgy or ceramics. For information, forms, etc., write to *Clyde E. Williams*, Director.

Alloy Metal Wire Co., Prospect Park, Pa., producer of wire, rod and strip in Monel metal, nickel, stainless steel and electrical resistance alloys are installing new equipment and making plant rearrangements now, in order to increase their capacity, improve their product and broaden their field in anticipation of a heavily increased demand.

South Bend Air Products, Inc., South Bend, Ind., was recently organized to purchase and continue the ventilating equipment business formerly conducted by the Industrial Fan Division, Bendix Products Corp. Departments: welding, grinding and buffing. Principal base metals used: steel, aluminum.

Bemie & Call Co., Springfield, Mass., will manufacture and market all products of the *Sesamee Co.* of Hartford, makers of keyless locks, in addition to its regular line of adjustable wrenches. Departments operated: stamping, welding, grinding, polishing, plating, tumbling, burnishing, buffing, lacquering and enameling.

Westinghouse Electric & Mfg. Co., has announced the early construction of new manufacturing and warehouse facilities at its E. Springfield, Mass. Works. The new manufacturing building will have approximately 100,000 sq. ft. of floor space. It will

TRADE MARK
MATCHLESS
REG. U.S. PAT. OFF.

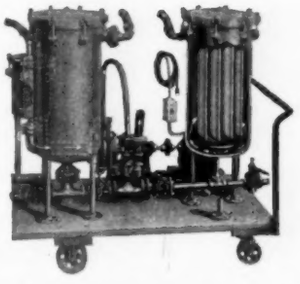
IDEAS and FACTS

A big mistake is often made by folks who have the IDEA that high quality finishes can be produced with low grade materials. The FACT remains however, that it cannot be done without an increase in the cost of production.

LET US PROVE THIS IN YOUR SHOP
WITH
MATCHLESS HIGH GRADE BUFFING COMPOSITIONS
BUFFS and POLISHING WHEELS
There is no substitute for "Matchless"

The Matchless Metal Polish Co.
840 W. 49th Pl., Chicago, Ill. 726 Bloomfield Ave., Glen Ridge, N. J.

INDUSTRIAL FILTERS FOR PLATING SOLUTIONS



Cut illustrates both closed & internal view of the filter unit.

NEW MODELS—for
BRITE NICKEL SOLUTION
RUBBERLINED—Filter Units
DURIRON—Pumps & Fittings
A TYPE & SIZE FOR EVERY REQUIREMENT.

Industrial Features—"CLOSED FILTRATION"—"NO LEAKING"—"NO LOSS OF SOLUTION".

Write for literature including specifications on filters for HOT & BRITE NICKEL, BRITE ZINC, & CHROMIUM.

INDUSTRIAL FILTER & PUMP MFG. CO.
3017 W. Carroll Ave. Chicago, Ill.

be used in the manufacturing of beverage coolers, air conditioning equipment, water coolers, commercial refrigeration units, electric fans, vacuum cleaners and room coolers.

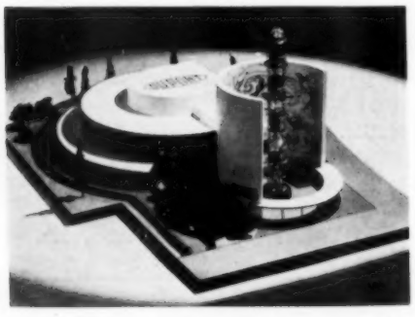
George H. Reama has been named factory manager for the *American Screw Company*, Providence, R. I. Mr. Reama was with the Winchester Repeating Arms Co. from 1911 to 1920, when he was appointed assistant mechanical superintendent of the Corbin Screw Corp. He returned to Winchester in 1923 and remained there until 1934. Since 1934 Mr. Reama has been employed by the General Electric Co. as superintendent of the Home Foundry Equipment Dept., and also as director and teacher of their Supervisory Training Program. Departments operated: rolling, pickling, polishing, degreasing, cleaning, plating, tumbling, burnishing and galvanizing. Principal base metals used: brass, steel, aluminum. This firm is interested in news or facts describing the latest type of burnishing and tumbling finishing equipment.

DuPont Building at World's Fair

Plans for an exposition building at the New York World's Fair, to house a series of dramatized exhibits depicting the social contributions of the modern chemical industry were announced recently by E. I. du Pont de Nemours & Company, Wilmington, Del.

The structure will have as its central feature a huge semi-cylindrical shell, 70 feet high, decorated with one of the largest mural paintings ever executed. The mural will be a symbolic one, portraying the significance of the chemist in industry, transportation, agriculture, mining and other fields.

The du Pont exhibit will be called "The Wonder World of Chemistry." All over cost of the exhibit is estimated at $500,000. Walter Dorwin Teague is the designer.



Model of the du Pont building at the New York World's Fair

Bridgeport Brass Expanding

With its new rolling mill, representing an approximate investment of $4,000,000, rapidly nearing completion, Bridgeport Brass Company, one of the largest of America's independent brass mill products manufacturers, swings confidently ahead on the 1938 scene.

The new mill covers a floor area of about 200,000 square feet and will be devoted to the production in sheet form of practically all the copper base alloys. It has special significance when viewed from two different standpoints. First, its construction has already given direct employment to an average of over 150 men per day since May 1, 1937 and provided a total of more than 28,300 man days' work during the past ten months, and has involved the purchase of important quantities of building materials and the creation of labor in many fields at a time when such activity is needed. More than 1,375 tons of structural steel, a total of more than 400,000 bricks, over 28,000 lights of glass with a sash area of 50,400 square feet, materials for 166,000 square feet of roof area and enormous quantities of other materials were utilized in the construction of the plant and adjoining office and laboratory building. An equally substantial outlay has been made for the purchase of modern machines, equipment and tools.

Second, it is important as an interesting departure from conventional brass rolling mill design. The direct flow of materials is the integral factor. In addition to allowing for the use of the most modern machinery and equipment available, it is planned with an eye to the growing importance of materials handling in efficient plant operation.

In this respect it follows the straight line principle which has proved to be so effective in the steel industry. Smooth, continuous flow of metals throughout all stages, from ingots to finished rolls, automatic devices for handling to insure the utmost speed and economy, ready adaptability to varying production requirements—these are the outstanding features of the mill. Every unnecessary movement in the various steps—rolling, scalping, annealing, pickling, coiling, slitting, finishing and loading for ship-

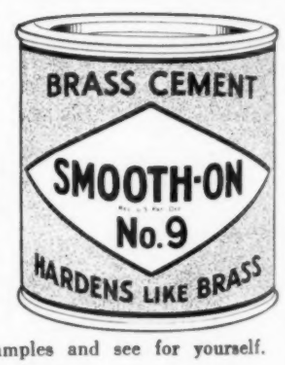
Filling cement for BRASS and BRONZE

SMOOTH-ON NO. 9

THIS cement is easily applied, adheres and hardens well, matches the color and surface texture of the surrounding metal, and can be filed, machined or polished to a fine finish.

As a filling for holes, rough surface or porous spots on castings, and for seams, cracks and open spaces between assembled parts, this composition gives the same satisfaction on brass and bronze as do the three grades of Smooth-On No. 4 Iron Cement on iron and steel surfaces.

The first application will prove its desirability for the purposes intended, and the saving of a few otherwise rejected pieces pays for all the cement required in a year. Make the trial and be convinced. The cost is almost nothing. Get free samples and see for yourself.



Buy Smooth-On No. 9 in ¼-lb. or 2-lb. can.

SMOOTH-ON MFG. CO., Dept. 18, 568-574 Communipaw Ave., Jersey City, N. J.

Do it with **SMOOTH-ON**

FOR QUALITY-PLUS PERMAG CLEANERS LEAD TRADE MARK REG. U.S. PAT. OFF.

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PERMAG has the answer because it is linked with the Magnuson Service of Research and Investigation. Hundreds of concerns have successfully used this service for their most difficult metal cleaning jobs. We are looking for more of these hard situations. Write us.

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Manufacturers of SPECIALIZED SCIENTIFIC CLEANING COMPOUNDS for EVERY INDUSTRIAL PURPOSE.

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ment—has been eliminated to avoid waste of time and effort.

The added efficiency of the new rolling equipment not only allows the use of heavier castings but permits greater accuracy in the finished rolls. Oil-fired annealing furnaces add still further to the achievement of more accurate standards. This modern equipment is typical of every operating unit in the mill.

The company's management expects that the mill will be in production by mid-summer.

Metal Market Review

March 24, 1938.

Copper suffered an anxious and distracted month. Although no change was made from the domestic price of 10c per pound, electrolytic, delivered Connecticut Valley, the general situation was decidedly tense.

The latter part of February showed improved sentiment abroad with consequently higher prices for export metal. With the advent of March, however, this interest declined and the recession became even more severe when February statistics were published, which showed that American stocks of refined metal increased by 27,111 tons although foreign stocks decreased by 3,227 tons. Sales week by week since our last issue were 7,813 tons, 9,488 tons, 4,468 tons, 2,975 tons, making a total of 24,744 tons, compared with 12,151 tons for the previous four weeks. Sales for February totalled 23,518 tons against 25,543 in January.

The present European political situation is playing such an important part in the copper market that it is impossible to venture opinion on even the present situation.

Zinc suffered another relapse, slipping from 4.75c per pound, Prime Western, E. St. Louis to 4.50, and again to 4.25. A temporary and very moderate seasonal increase in business among galvanizers was ineffective against the influence of unfavorable February statitics showing that zinc stocks in the United States had increased 19,606 tons. High grade zinc is also suffering because of the continued low rate of operations in the automobile industry.

At the present time quotations are steady but the market is practically stagnant.

Tin spent the month in the doldrums. It was last quoted here at 41.75c per lb. Straits and since then has fluttered between a high of 42.75 and a low of 41. Present price 41.4. Demand has been dull throughout. Tin is another of the metals highly susceptible to the continental political situation and is like copper, at this moment, marking time.

Lead prices remain unchanged at the figure last quoted here, 4.35c per pound E. St. Louis. Sales were in good volume during the last two weeks of February but tapered off sharply thereafter: 7,776 tons, 6,605 tons, 1,555 tons and 1,100 tons making a total of 17,036 tons compared with 7,100 tons in the previous four weeks.

Statistics showed a sharp reduction in the

Costs Cut over 35%

SEE PAGE 24 OF NEW BOOKLET ON AMERICAN BONDED METALS

This handsomely illustrated new booklet shows how alert manufacturers in *all* fields are finding new beauty and new production economy with PRE-FINISHED American *Bonded* Metals. It's full of valuable data and ideas for *you*. Write now for your free copy. No obligation.

AMERICAN NICKELOID COMPANY
8 SECOND STREET, PERU, ILLINOIS
Sales Offices in All Principal Cities

STANLEY

66E-656 ALUMINUM SYNTHETIC

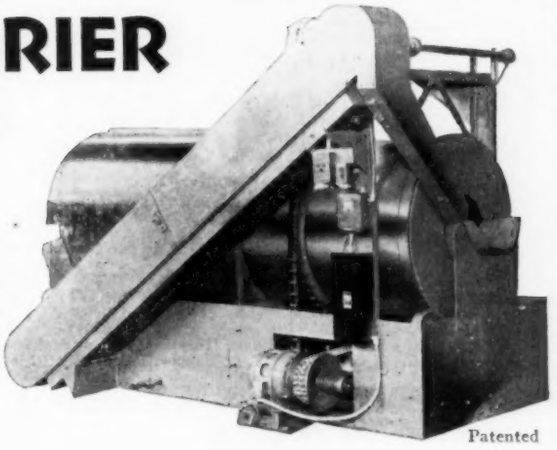
Air Drying	Is tack free in 20 minutes. No baking necessary.
Brilliant, Smooth, Durable	Provides a finish of exceptional brilliance and smoothness, has excellent adhesion, durability and weathering qualities.
Dipping Characteristics	Has phenomenal flow and dipping characteristics. It is equally suitable for spray application.
Non-Settling	Only normal stirring is required before use.

THE STANLEY CHEMICAL COMPANY
EAST BERLIN, CONN.
Lacquers • *Enamels* • *Synthetics* • *Japans*
A Subsidiary of THE STANLEY WORKS, New Britain, Connecticut

IDEAL
TRADE MARK REG. U.S. PAT OFF.
DRIER

SAVES $1200 PER YEAR

In one plant this sawdust drier dries plated and dipped work — as many as 30 batches per hour—at a cost saving of $100 a month. And the finish is improved too! Ask for details.



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Put it up to Specialists

N. Ransohoff Inc.
West 71st St. at Millcreek, Carthage, Cincinnati, O.

We also manufacture washing, rinsing, drying, tumbling, burnishing, pickling and plating equipment.

Trade Mark Reg.
U. S. Pat. Office

COMPOSITIONS FOR Buffing and Polishing

FEATURE

LIME FINISH—The all-around performer; for chrome, nickel and copper.

TRIPOLI—For every type of work.

COLORING COMPOSITION—A remarkable number where cut and color is desired.

GREASE STICK — EMERY CAKE

SAMPLES, PRICES AND INFORMATIVE BOOKLET ON REQUEST
WRITE DEPT. A

THE BUCKEYE PRODUCTS CO.
Cincinnati, Ohio
Manufacturers For Nearly Thirty Years

IT'S A LONG ONE!

LEAD LINED AND LEAD COVERED, TOO.

BUT SIZE
IS NO PROBLEM FOR OUR ENGINEERS AND MECHANICS. WE ARE WELL EQUIPPED FOR IT.

SEND US YOUR INQUIRIES

THE HAUSER-STANDER TANK CO.
4838 SPRING GROVE AVE. CINCINNATI, OHIO

CLEPO *Not just a cleaning compound but a*

Scientific Cleaner Service . . .

Metal Cleaning is a simple matter when everything is right. But everything is right only when the cleaning operation begins where the cleaning compound is made, and ends in your plant through the medium of unremitting service by the maker of the compound. **CLEPO** cleaning compounds are sold on that basis.
CLEPO service does not consist simply of leaving you with a quantity of chemical. It includes a definite effort to aid you in fitting the right cleaner to each job in your plant. We believe this method is the only means by which you can reduce rejects to the barest minimum and eliminate blistered or peeled deposits, or other defects caused by improper cleaning.
CLEPO cleaners do this because they are scientifically compounded of high purity chemicals; always uniform; always supported by **CLEPO** service.

FREDERIC GUMM CHEMICAL CO., INC.
538-542 FOREST STREET KEARNY, NEW JERSEY
TECHNICAL ADVISORS and SALES REPRESENTATIVES
OLIVER J. SIZELOVE, General Technical Advisor and Sales Representative
WILLIAM VOSS — JACOB HAY — GEORGE GEHLING
METROPOLITAN — WESTERN — PHILADELPHIA

output of refined lead in January, in spite of which stocks increased 4,270 tons.

Present status rather dull with prospects involved in the tangled European political situation.

Silver showed no change whatever, the New York official price remaining at 44.75c per ounce Troy.

LATE FLASH: Immediately after an announcement that they would cease buying Mexican silver on April 1, the U. S. Treasury reduced its open market price from 45c to 44c, and, a day or two later, to 43c.

Scrap Metals were active during the latter part of February but eased during March, following the trend of the export market and showing the effect of the decidedly tight European situation. In spite of a softer market, however, scrap offerings are rather limited at this moment. Brass ingot activity swung widely during the past four weeks. During the latter part of February it was slow then picked up sharply and then reacted again. Aluminum ingots were slow.

A preliminary survey by the Bureau of Mines indicated that the primary refiners of copper produced about 160,000 tons of metal from secondary copper in 1937 compared with 132,915 tons in 1936. Production of lead from secondary metal by primary refiners receded from 34,556 in 1936 to about 32,500 tons in 1937.

On March 1st unfilled orders on the books of the members of the Non-Ferrous Ingot Metal Institute amounted to 11,935 net tons against 12,821 net tons on February 11th.

The combined deliveries of brass and bronze ingots and billets for members in the month of February amounted to 2,756 tons compared with 2,774 in January.

The Institute reports the range prices per pound received by its members during the 28-day period ending February 18:

	4 wks. end. Feb. 18	4 wks. end. Jan. 21
80-10-10	11.933	12.770
78% Metal	9.307	10.250
81% Metal	9.807	10.595
83% Metal	9.777	10.702
85% Metal	10.204	11.040
No. 1 Yellow	8.623	9.039

Average Prices for Metals

	Feb.
COPPER c/lb. Duty 4c/lb.	
LAKE (del. Conn. Producers' Prices)	10.062
ELECTROLYTIC (del. Conn. Producers' Prices)	10.000
CASTING (f.o.b. ref.)	9.525
ZINC (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb.	
Prime Western (for Brass Special add 0.05-0.10)	4.816
TIN (f.o.b. N. Y.) c/lb. Duty Free, Straits	41.271
LEAD (f.o.b. St. L.) c/lb. Duty 2½ c/lb.	4.482
ALUMINUM c/lb. Duty 4 c/lb.	20.000
NICKEL c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.000
ANTIMONY (Ch.) c/lb. Duty 2 c/lb.	15.737
SILVER c/oz. Troy, Duty Free	44.750
PLATINUM $/oz. Troy, Duty Free	35.342
GOLD—Official U. S. Treasury Price	35.000

INFORMATION FOR BUYERS

MANUFACTURERS' LITERATURE

PLEASE MENTION APRIL METAL INDUSTRY

Automatic Start Induction Polyphase Motors; for general purposes. Century Electric Co., St. Louis, Mo.

Steam Jets, Ejectors, Tank Outlets and Spray Nozzles. The Durion Co., Dayton, Ohio.

Metallographic Equipment and Accessories. Catalog E-225. Bausch & Lomb Optical Co., Rochester, N. Y.

Automatic Hardware; for automobiles, buses, funeral cars, taxicabs. Catalog No. 21. Attwood Brass Works, Grand Rapids, Mich.

Portable Heat Treating and Carburizing Furnaces. Enclosed front type oil fuel; suitable for annealing, hardening, etc. W. S. Rockwell Co., 50 Church St., New York.

Pyrometer Potentiometer; offered as a pyrometer and tachometer, resistance thermometer, millivoltmeter. Bulletin 507. The Bristol Co., Waterbury, Conn.

Direct Current Motors. Designed to meet a wide range of requirements. Bulletin 2260. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

High-Strength Alloys for Corrosion Resistance. Hastelloy. Haynes Stellite Co., Kokomo, Ind.

Resistance Welding with Ignitron Split-Second Control; for spot, seam, butt and projection welding. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

Protection Against Explosion and Corrosion. "De-Ion," oil immersed, motor starters. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

Ingot Metals and Alloys. A handsomely bound booklet occasioned by the 50th anniversary of the company; describing red brass, manganese bronze, yellow brass, aluminum bronze, nickel silver, deoxidizers, hardeners, white metals, and aluminum. Excellent technical data. H. Kramer & Co., 21st & Loomis Sts., Chicago, Ill.

Simplified Prices for Coated Abrasives. Covers every available size, shape, kind, grit, coating and backing. Behr-Manning Corp., Div. Norton Co., Troy, N. Y.

"Picking Profits Out of the Air," by *F. A. Ebeling.* Dust collection in the manufacturing plant. The W. W. Sly Mfg. Co., Cleveland, Ohio.

The Housing Program vs. Rent and Population Trends. Booklet No. 25 in a series by Allen W. Rucker in collaboration with N. W. Pickering, President, Farrel Birmingham Co. Inc., Ansonia, Conn.

Centrifugal Pumps; for a wide range of application in industry. Bulletin No. 210. Goulds Pumps Inc., Seneca Falls, N. Y.

Rubber Manufacture—a Growing Industry by *J. W. Schade,* director of research, B. F. Goodrich Co., Akron, Ohio.

Black-Ray Projector; produces ultra-violet or black light for fluorescence examination. Black-Ray Lighting Co., 10415 St. Clair Ave., Cleveland, Ohio.

WALKER'S
INDUSTRIAL
FINISHES

For Metal Products
Lacquers and Synthetics

Quality, Service, and a background of accomplishment, supported by an up-to-date laboratory and highly trained personnel.

H. V. WALKER COMPANY
ELIZABETH New Jersey

New England Warehouse
Brown and Dean Co., Providence, R. I.

"FINISHES TO FIT THE PRODUCT"

FOR BRILLIANT CHROME
TRY
NATROLIN
B-4 CHROME CLEANER
Removes Lime, Grease, etc., after nickel buffing.
GUARANTEED

Also
McKEON'S
"Liquid Sulphur"
TRADE MARK REG'D
The Oxidizing Agent of Today

SULPHUR PRODUCTS CO.
Greensburg, Pa.

Supply Prices, March 24, 1938

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast ..... 19⅝c. per lb.
Electrolytic, full size, 14⅝c. cut to size ..... 14⅝c. per lb.
Rolled oval, straight, 15⅛c.; curved ..... 16⅛c. per lb.

BRASS: Cast ..... 18⅜c. per lb.

ZINC: Cast ..... 11¼c. per lb.

NICKEL: 90-92%, 16" and over ..... .45 per lb.
95-97%, 16" " " ..... .46 per lb.
99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48.

SILVER: Rolled silver anodes .999 fine were quoted March 24, from 48c. per Troy ounce upward, depending on quantity.

White Spanish Felt Polishing Wheels

Diameter	Thickness Under ½"	½-15/16"	1-2"	2-3½"	Over 3½"
Under 1"	6.35-6.40	6.20-6.25	6.10-6.15	6.10-6.15	6.35-6.40
1" to 1 7/16"	5.85	5.70	5.60	5.60	5.85
1½" to 3 15/16"	5.55	5.35-5.40	5.30-5.35	5.30-5.35	5.60
4-5 15/16"	4.95-5.00	4.70-4.85	4.65-4.75	4.65-4.75	4.95-5.00
6", 8" & 9"	3.80-4.25	3.45-3.95	2.45-3.05	2.45-3.00	2.90-3.35
10" to 18"	3.80-4.25	3.45-3.95	2.45-2.95	2.45-2.85	2.90-3.25
Over 18"	3.80-4.25	3.45-3.95	2.70-3.05	2.70-3.00	2.90-3.35

Prices above are for less than 50 lb. For 50 to 99 lb. deduct from 30c per lb. to 5% from list; for 100 lb. and over deduct from 50c per lb. to 10%.

ODD DIAMETERS: (7" & 11" to 17"). Less than 50 lb. add 40c per lb. to above "Even Diameters" list. 50 lb. or over—all one size and consistency and in one shipment—same as "Even Diameters" list above.

On grey Mexican wheels deduct 10c per lb. from above prices.

Cotton Buffs

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$75.24
14" 20 ply 84/92 Unbleached	57.67
12" 20 ply 84/92 Unbleached	43.28
16" 20 ply 80/92 Unbleached	63.28
14" 20 ply 80/92 Unbleached	48.57
12" 20 ply 80/92 Unbleached	36.52
16" 20 ply 64/68 Unbleached	59.69
14" 20 ply 64/68 Unbleached	45.84
12" 20 ply 64/68 Unbleached	34.49

⅜" Sewed Buffs, per lb., bleached or unbleached 54c to 90c

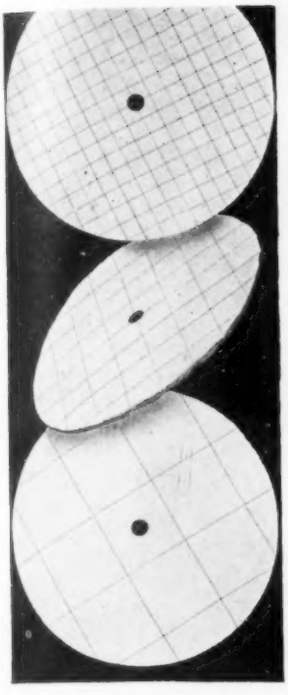
Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P. l.c.l. Drums	lb.	.06¼
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 100 lb. and 400 lb. drums		.16¾-.17¼
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.027
Hydrochloric, C. P., 20 deg., carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07½
Sulphuric, 66 deg., carboys	lb.	.02½
Alocohol—Butyl, drums (f.o.b. destination)	lb.	.10-.10½
Denatured, carloads (f.o.b. prod. pts.)	gal.	.35-.40
Alum—Lump, barrels	lb.	.0340-.0365
Powdered, barrels	lb.	.0355-.0380
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05¼
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0255-.0305
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.35
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05¾-.06
Chrome, Green, commercial, bbls.	lb.	.22
Chromic Sulphate, drums	lb.	.26¼
*Copper—Acetate (Verdigris)	lb.	.25
Carbonate, 53/55% cu., bbls.	lb.	.14½-.15½
Cyanide (100 lb. kgs.)	lb.	.37
Sulphate, tech., crystals, bbls.	lb.	.0495
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium 41%		$15.45
*Gold Cyanide, Sodium 46%		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.11-.13¾
Oxide (Litharge), bbls.	lb.	.12½
Lime Compositions for Nickel	lb.	.09½-.11
Lime Compositions for Brass	lb.	.09½-.11
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums l.c.l.	gal.	.40½
Nickel—Carbonate, dry bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅝
Potassium—Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 98-100%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38¾
Cyanide, 100 oz. lots	oz.	.44¾
Nitrate, 100 ounce lots	oz.	.33¼
Soda Ash, 58%, bbls.	lb.	.0235
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	3.15
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.28-.31
Sulphocyanide, drums	lb.	.30-.35
Sulphur (Brimstone), bbls.	lb.	.02⅝
*Tin Chloride, 100 lb. kegs	lb.	.34
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
White Silica Compositions for Brass	lb.	.07½-.10
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.14-.15
Cyanide (100 lb. kegs)	lb.	.36
Chloride, drums, bbls.	lb.	.065
Sulphate, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Metal Prices on page 216.



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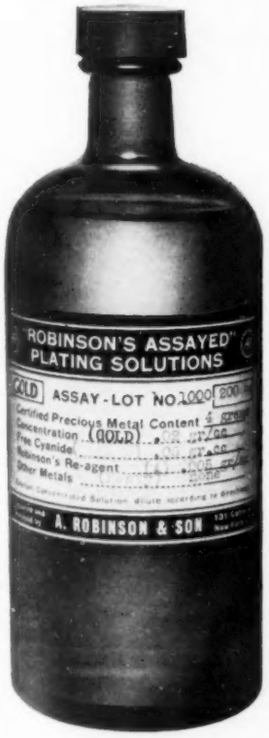

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Copper	Brass
Cadmium	Zinc

CHEMICALS

Nickel Salts	Copper Sulphate
Nickel Chloride	Copper Cyanide
Nickel Carbonate	Copper Carbonate
Chromic Acid	Cadmium Oxide

Manufactured by

THE McGEAN CHEMICAL COMPANY
CLEVELAND, OHIO

McGEAN CHEMICALS

Metal Prices, March 24, 1938

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

New Metals

COPPER: Lake, 10.125, Electrolytic, 10.00, Casting, 9.525.
ZINC: Prime Western, 4.25. Brass Special, 4.35.
TIN: Straits, 41.25. LEAD: 4.35.
ALUMINUM: 20. ANTIMONY, Ch. 15.75.
NICKEL: Shot, 36. Elec., 35.

QUICKSILVER: Flasks, 75 lbs., $72-73.50. BISMUTH, $1.00.
CADMIUM, $1-1.35. SILVER, Troy oz., official pr. N. Y., Mar. 24, 44¾c.
GOLD: Oz. Troy, Official U. S. Treasury price $35.00.
SCRAP GOLD, 6¾c. per pennyweight per karat, dealers' quotation.
PLATINUM, oz. Troy $35.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Ingot Metals and Alloys

	Cents lb.	U. S. Import Duty	U. S. Import Tax*
No. 1 Yellow Brass	8.50	None	4c. lb.[1]
85-5-5-5	10.25	None	4c. lb.[1]
88-10-2	13.75	None	4c. lb.[1]
80-10-10	12	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	10.50	None	4c. lb.[1]
Aluminum Bronze	14.75	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	12.50	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	14.75	20% a. v.	4c. lb.[1]
No. 12 Aluminum	16.25-19	4c. lb.	None
Manganese Copper, Grade A (30%)	23-28	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	15.00	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	16.00	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	21.50	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	50-60	None	None
Iridium Platinum, 5% (Nominal)	$38-40	None	None
Iridium Platinum, 10% (Nominal)	$40-42	None	None

*** Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.**
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

Old Metals

Dealers' buying prices, wholesale quantities:

	Cents. lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	6⅜ to 6½	Free	4c. per pound on copper content
Light copper	5⅝ to 5¾	Free	
Heavy yellow brass	4¾ to 5¼	Free	
Light brass	3⅝ to 3⅞	Free	
No. 1 composition	6⅛ to 6¼	Free	
Composition turnings	5⅜ to 5⅞	Free	
Heavy soft lead	3¼ to 3¾	2⅛c. lb.	
Old zinc	2 to 2¼	1½c. lb.	
New zinc clips	3 to 3¼	1½c. lb.	
Aluminum clips (new, soft)	13¼ to 13½	4c. lb.	
Scrap aluminum, cast	7¾ to 8	4c. lb.	
Aluminum borings—turnings	6 to 6¼	4c. lb.	None
No. 1 pewter	24 to 25	Free	
Electrotype	4 to 4¼	2⅛c. lb.*	
Nickel anodes	29 to 30	10%	
Nickel clips, new	30 to 31	10%	
Monel scrap	7½ to 13½	10% av.	

*** On lead content.**

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacurers' lists, effective since March 14, 1938. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

Copper Material

	Net base per lb.	Duty*
Sheet, hot rolled	18⅛c.	2½c. lb.
Bare wire, soft, less than carloads	14⅛c.	25% a. v.
Seamless tubing	18⅝c.	7c. lb.

*** Each of the above subject to import tax of 4c. lb. in addition to duty under Revenue Act of 1932.**

Nickel Silver

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	26⅜c.	10% Quality	29 c.
15% Quality	28½c.	15% Quality	33⅜c.
18% Quality	29¾c.	18% Quality	36⅝c.

Brass and Bronze Material

	Yellow Brass 80%	Red Brass Comm'l. Bronze	Duty	
Sheet	16⅜c.	17¼c. 18⅛	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	16⅝c.	17½c. 18¼	20%	
Rod	12⅜c.	17½c. 18¼	4c. lb.	
Angles, channels	24⅞c.	25¾c. 26⅝	12c. lb.	
Seamless tubing	19¼c.	19¾c. 20½	8c. lb.	
Open seam tubing	24⅞c.	25¾c. 26⅝	20% a. v.	

Tobin Bronze and Muntz Metal

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	18¼c.
Muntz or Yellow Rectangular and other sheathing	19⅝c.
Muntz or Yellow Metal Rod	15¾c.

Aluminum Sheet and Coil

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, carload lots, per lb.	33.00c.
Aluminum coils, 24 ga., base price, carload lots, per lb.	28.50c

Rolled Nickel Sheet and Rod

Net Base Prices

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Hot Rolled Rods (base)	35c.	No. 35 Sheets (base)	37c.
Cold Drawn Rods (base)	40c.	Std. Cold Rolled Sheets (base)	39c.

Silver Sheet

Rolled sterling silver (March 24) 47c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

Zinc and Lead Sheet

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots standard sizes and gauges, at mill, less 7 per cent discount	10.00	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	11.00	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	15.00	2c. lb.
Full Lead Sheet (base price)	7.50	2⅜c. lb.
Cut Lead Sheet (base price)	7.75	2⅜c. lb.

Block Tin, Pewter and Britannia Sheet

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 214.